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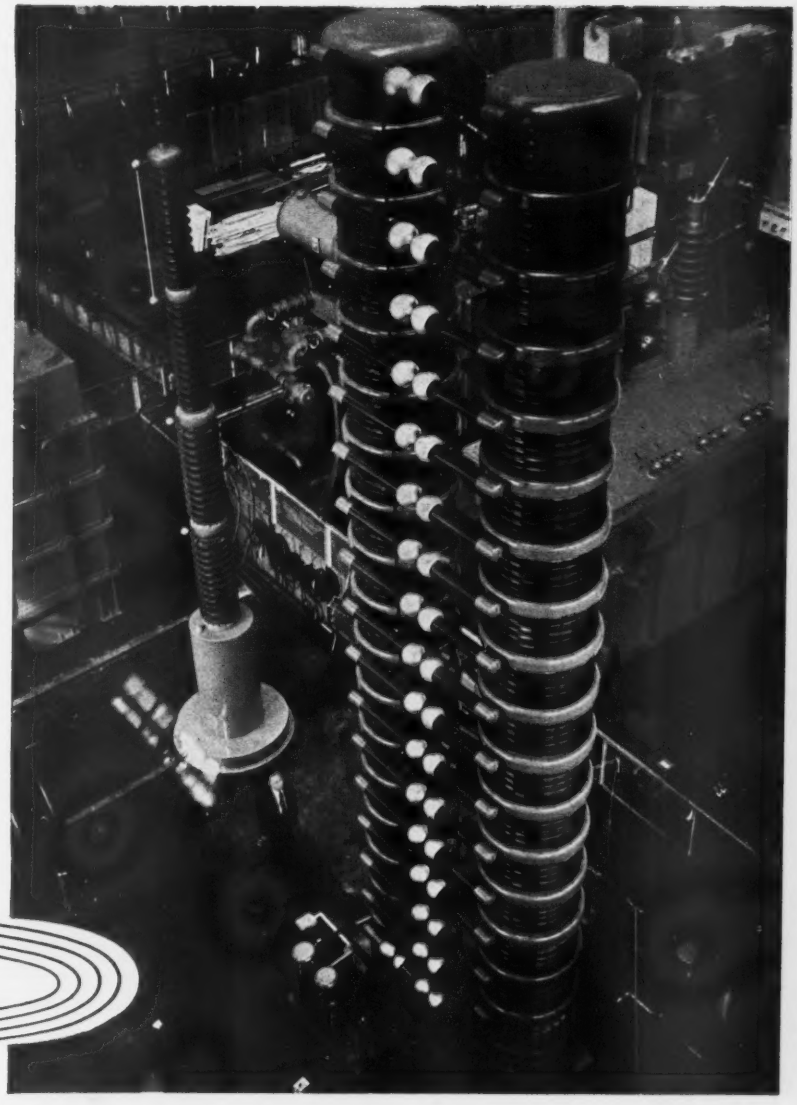

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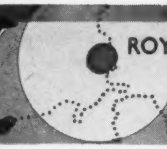

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ELECTRICAL REVIEW

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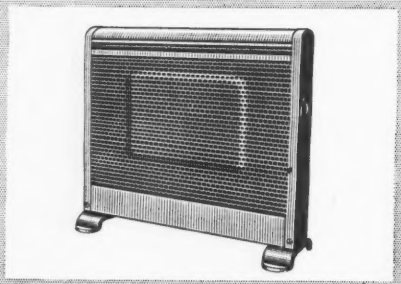

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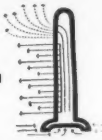

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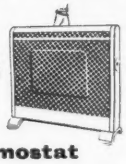

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ELECTRICAL REVIEW

17 February 1956 Vol. 158 No. 7 Established 1872

Power Plant Orders

ONE of the stranger recommendations of the Herbert Committee of Inquiry into the Electricity Supply Industry was that relating to the purchase of plant. To quote the Committee's own words:—

> " The Electricity Boards should seek the best and cheapest plant, taking maintenance and servicing into account, irrespective of origin. They should not circumscribe their own commercial freedom to buy in the most advantageous market by assuming limitations of the national interest which have not been directly determined by the Minister."

Leaving aside the apparent equation of " best and cheapest," we consider that the Central Electricity Authority is quite right to assume that it is in the national interest to place its orders in this country. The Committee should have been well aware that no Minister would give a specific ruling on such a delicate subject, however much he might agree with the C.E.A.'s action.

In the Report there is a rather cheap sneer at the Heavy Electrical Plant Consultative Council which has a majority of manufacturers in its membership. These manufacturers, it is said, " would find it unwelcome if their principal home customer went abroad for major plant items, especially as their prestige in the export field might suffer." This seems to imply that loss of prestige would merely wound the manufacturers' pride: there is no suggestion that the country might suffer from the loss of valuable export orders. Probably all the Committee had in mind was that a threat by the C.E.A. to go abroad for plant would be sufficient to make British manufacturers reduce their prices; the Committee suggests, without saying so definitely, that manufacturers have been overcharging.

To overcome the heavy plant arrears arising from wartime and post-war conditions the manufacturers have made vast extensions to their works and they have not only met the C.E.A.'s requirements but have been able to increase their exports to the extent of making the electrical industry the country's second largest exporter. To achieve this they have had to rely, in common with most other industrial concerns, on financing by means of " ploughed-back " profits which has naturally meant higher charges. This is considered to be orthodox nowadays and, in fact, the C.E.A. itself has been instructed to adopt the method—although the Herbert Committee does not agree with it.

Some critics may question whether it is wise or right for the C.E.A. to order plant only from British manufacturers when those manufacturers expect to compete in overseas countries on equal terms with native producers. The answer to this is that Great Britain must export manufactured products to pay for her food and raw materials, while the United States, for instance, is not under such severe compulsion in this respect. Other manufacturing countries will look for their trade in other markets than Great Britain and it is in such markets that we have to meet their competition. We can succeed only if we have a firm home demand.

HIGHER TECHNICAL EDUCATION

According to a Sunday paper the Government White Paper outlining a five-year programme of expansion in technical education which is to be issued shortly envisages great expansion of such centres of technical education as the Imperial College of Science and Technology in London and the Universities of Glasgow, Manchester, Birmingham and Leeds. This in itself would seem to be above criticism and when we hear that the eagerness of British industrialists to assist in tackling this national problem is to be given a further chance of practical expression in that highly qualified specialists from firms in these centres are to be asked to give more time to teaching at the universities and colleges we cannot but applaud the scheme. It would seem that there is a danger that the modern sentimental attitude towards "parity of esteem" has weakened the Government proposals, for we read that the new Diploma of Technology will be considered equivalent to the B.A. honours (and presumably B.Sc.) degrees. If British industry is to survive it must be through an increase in the number of trained and qualified personnel at all levels, and also through rigid insistence on the supremacy, in their own sphere, of university degrees, in order to maintain the highest academic and technical standards.

SIR GEORGE NELSON

President of the Institution of Electrical Engineers

H.R.H. THE DUKE OF EDINBURGH will be the principal guest when the Institution of Electrical Engineers holds its Annual Dinner on Thursday next, the 23rd February.

Sir George H. Nelson, Bt., F.C.G.I., M.I.Mech.E., President of the Institution, will preside. We have thought it appropriate to mark this occasion by reproducing, on the facing page, a photograph in direct colour of the President which has been specially taken for the *Electrical Review*.

HEAT AND POWER LINKAGE

In his article under the above heading in this issue, Mr. C. Ungoed shows how important it is as a means of conserving fuel to maintain a proper balance between the use of heat and electric power in factories where private generation of electricity is undertaken and the exhaust steam, either by back pressure or pass-out, is used for factory processes. Mr. Ungoed gives a wealth of examples of how improvements can be made in this respect, but underlying them all is the question of balance. This is not only important to the factory management in ensuring the economical generation of electricity, but there are also repercussions which affect public electricity supply in those cases where private generation is augmented by public supply and particularly where private generation and public supply run in parallel.

ELECTRONICS AND PRODUCTIVITY

The papers which were read last week at the Electronics and Productivity Conference which was held in Glasgow under the auspices of the South of Scotland Electricity Board all show the weighty influence which automatic control is exercising over to-day's call for ever higher production. We emphasize automatic control because we regard electronic control as essentially one aspect of electric control and we are relieved to find that the term "automation" was not overdone as it might have been in a symposium of papers of this description. Possibly the only reference to automation was a comment by Mr. J. E. Fielding that the remarkable ability of electronic apparatus to operate powerful self-balancing servo-mechanisms was the main feature of automation. Each of the nine papers read at the conference dealt with a different aspect of production. The catholicity of electronic control was stressed by Mr. R. J. F. Howard who said that, in addition to straightforward speed control, such variables as pressure, flow, temperature and tension were regulated by this means.

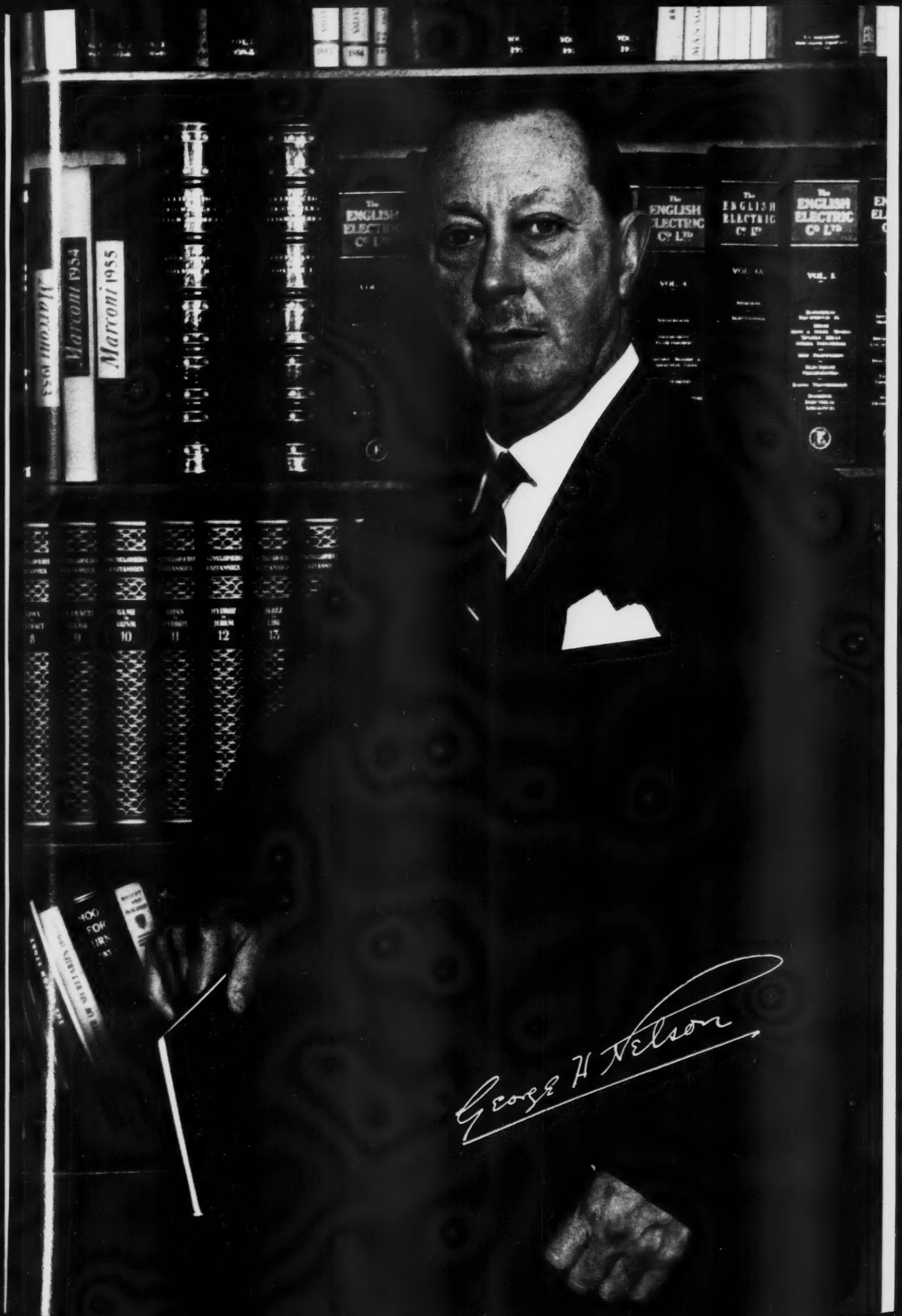
PRACTICABLE REACTORS

In his assessment of nuclear reactors for the generation of power, briefly summarized in this issue, Mr. C. E. Iliffe refers to the bewildering array of possibilities that face the designer. Which of these reactors will ultimately prove to be economical is, to quote Sir Christopher Hinton, more than can be safely predicted to-day. The devotion of further research to securing higher efficiencies in the use of the heat potentially available from nuclear fission is, of course, necessary as a long term measure, but what is essential to meet the immediate needs of this country in particular is the perfection of designs that make the best immediate use of available resources for large scale generation, coupled with the lowest development costs, safety and reliability. By concentrating his attention on designs that promise to achieve this aim in the near future Mr. Iliffe should do much to clarify a position that to many engineers has been somewhat obscure.

A.C. RAILWAY SUPPLIES

The well established merits of direct current in railway electrification were not called in question by Messrs. E. L. E. Whitehead and H. H. C. Barton in their I.E.E. paper, which was reviewed last week. Essentially the issue is whether a.c./d.c. conversion can be effected more economically at substations placed at intervals along the route or on the locomotives themselves. Where trains are run frequently, as in suburban services, the orthodox d.c. system seems likely to hold its own, though French experience is that recent technical developments have raised the traffic density at which single-phase at 50 c/s has advantages over d.c. Higher track distribution voltages and lighter overhead equipment are important advantages of alternating current, and the potentialities of semi-conductors as rectifiers are likely to influence the position in favour of a.c. supply at standard frequency.

Manoa 1953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HEAT AND POWER LINKAGE

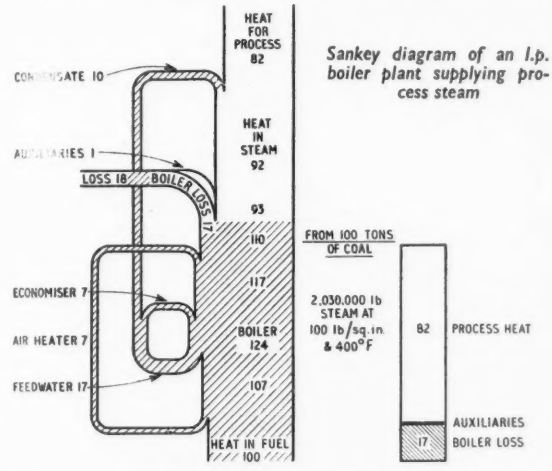
A Survey of Possible Improvements

By W. P. C. UNGOED*

IT should hardly be necessary to stress the present importance of fuel economy in any shape or form. Irrespective of our national fuel deficit, large as it is, the aspect of keen international trade competition, and greater productivity for our given manpower, must be considered. This serious deficit in the fuel economy will remain with us, and it is now of paramount importance to ensure that the usable output from our fuel resources is the maximum, and that fuel wastage reflecting back as unproductive man-shifts at the colliery, be kept at the minimum.

It is too much to expect that the advent of nuclear power will redress the unfavourable fuel balance in the immediate future. The development time for this new project will require an interval of 10 or 15 years even under the most optimistic circumstances, during which production increases will require corresponding increases in fuel supplies.

In particular, authoritative surveys have shown that there is still a considerable total weight of solid fuel being burnt inefficiently in old plant, to produce low-pressure steam, while at the same works demands for power are being met by imported electricity. These smaller industries should now be the target for an urgent national fuel economy drive. It is, therefore, of the utmost importance that heat and power schemes be introduced wherever practicable and possible, as a safeguard to the maintenance of full employment and the high level of prosperity.

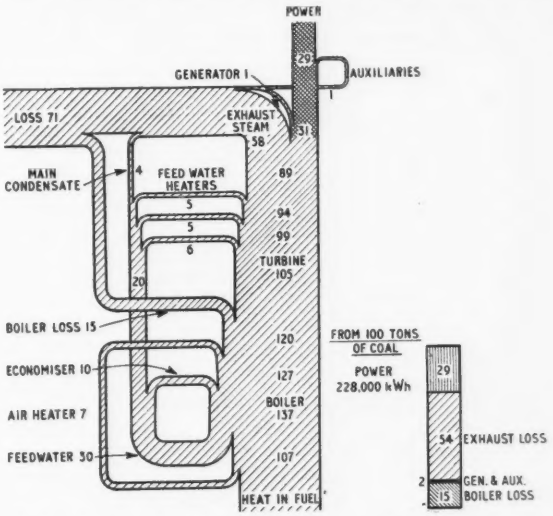


Sankey diagram of an l.p. boiler plant supplying process steam

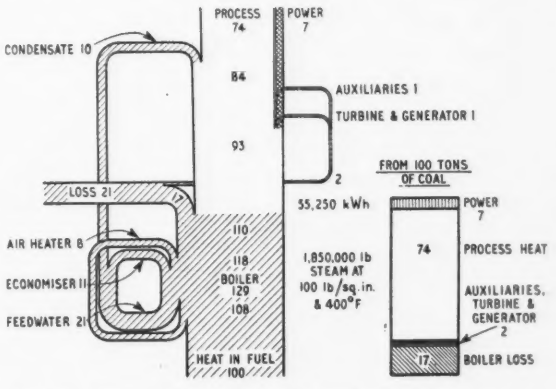
The carrying out of the works thermal survey is essentially an accurate compilation of the instantaneous and long-term requirements for (*a*) electrical power, (*b*) mechanical power, (*c*) process steam, (*d*) high-pressure hot water, and (*e*) preheated air. Before formulating any hard and fast summary of requirements, the opportunity should not be overlooked of modifying the various heat and power needs into more economical forms; for example, provided that a demand for l.p. exhaust steam exists, it is cheaper from the capital and operating points of view to install small steam turbine drives in place of the conventional a.c. motors. Similarly, economies in process heating can be effected by the use of closed circuit high-pressure hot water systems, in preference to direct steam injection. Alternatively, a heating demand can sometimes be met by the use of heated air, piped from air cooling systems.

It rarely happens that steam and power demands can exactly be supplied by a simple back pressure turbine operating at an initial steam pressure chosen to allow the necessary heat drop between inlet and exhaust corresponding to the required electrical output. It is almost inevitable that there will be some overlapping of the requirements, resulting in further plant additions, and/or flexibility as regards the import of electricity from the Central Electricity Authority.

It is also sometimes found that the process steam demand consists of a multiplicity of pressures. It is undoubtedly far more economic from the control point of view to group these pressures, wherever possible, supplying them at one



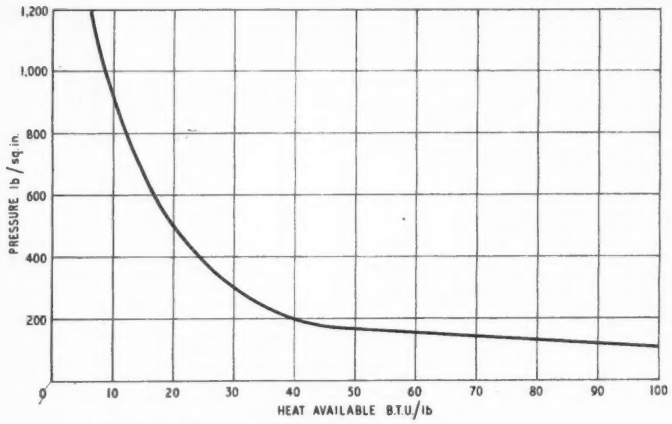
Sankey diagram of a boiler/condensing turbo alternator supplying electricity only



Sankey diagram of a combined boiler/back pressure turbine supplying process steam and electricity

* Mr. Ungoed is with the Steel Company of Wales.

common pressure. The introduction of turbine pass out points for multi-pressure operation is undoubtedly attractive, but the uncertainty of production steam requirements, and possible changes in such conditions can so easily render inoperative an otherwise excellent turbine scheme. The simple back pressure turbine has far more to commend it. It will be found that this type of turbine is cheaper from the point of view of capital cost and it avoids the control systems needed for multi-pressure operation.



Work equivalent of equal pressure increments

The three Sankey diagrams reproduced on the preceding page show the overall thermal efficiency of a comparable l.p. boiler plant supplying steam to process, a modern condensing power station operating at 900 lb/sq in and 900 deg F producing electricity only, and a modern combined industrial plant supplying part electricity, part process steam. The overall efficiency of the combined steam and power plant shows up extremely well as compared with a modern power station, and even more so with a straight l.p. boiler plant.

The examples quoted are representative of good modern practice, but on average, the straight l.p. steam boiler plant is generally of much older vintage and lower efficiency. The ratio of steam/electricity in the combined plant is capable of being varied within narrow limits by variations in the initial steam pressure, the turbine efficiency and the exhaust pressure. The diagram above shows the advantages obtained by progressively lowering the pressure of the exhaust steam from the back pressure turbine, as the work potential for equal pressure increments increases rapidly with decreasing steam pressure and especially below 100 lb/sq in.

Waste Heat Utilization

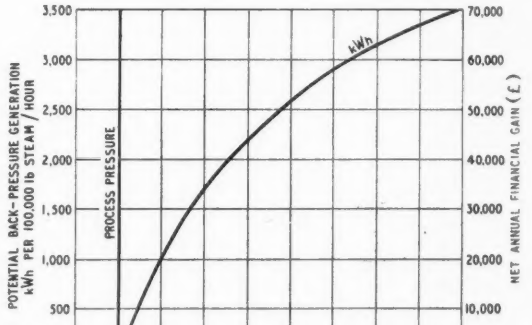
It is desirable when planning a heat and power scheme that all forms of heat arriving as by-products of the works should be successfully utilized. It is now fortunately rare to find site produced solid and gaseous fuels being rejected to waste, but the raising of additional steam from waste heat boilers is by no means universal. The early technical difficulties associated with this type of plant led to their abandonment in one or two isolated cases, leaving a certain amount of prejudice against their use. There is now no justification at all for this form of steam raising to be excluded, as there is no outstanding technical problem in the operation of this type of boiler. Opportunity should not be lost of including some of the more unusual forms of heat, where they exist and where a demand can be met. In particular, steam heated air dryers are common, and at the same time no serious attempt is made to recover the heat from electric motor forced cooling systems. There is the obvious saving in the steam demand, and the easing of the ventilating problem by this combination.

A further complication in the use of site produced solid and gaseous fuel is that the supply is rarely in exact phase with the thermal demand of the plant. Whereas solid fuels normally present no difficulty in storing, it is extremely doubtful whether the gaseous fuels of low calorific values can be economically stored, when the capital investment involved in storage is considered.

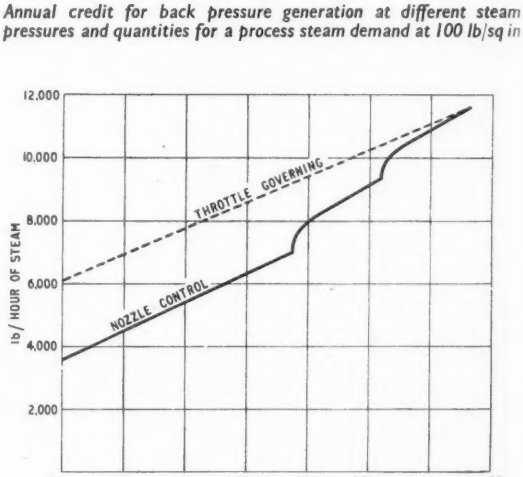
The possible heat and power combinations embodying the heat pump in industrial processes are clearly both numerous and diverse, but the position has certainly been reached, that all cases, in which the heat is supplied directly by the combustion of fuel, should be carefully examined for the possible application of final heat recovery in this manner.

A study of the overall statistics of boiler plant will determine the number and output of the boilers required and a correct choice of the component items making up the boiler. The design of combustion equipment will mainly centre around the efficient combustion of existing waste fuels on site, coupled with other liquid or solid auxiliary fired plant with equal combustion efficiency.

For the average size of modern industrial



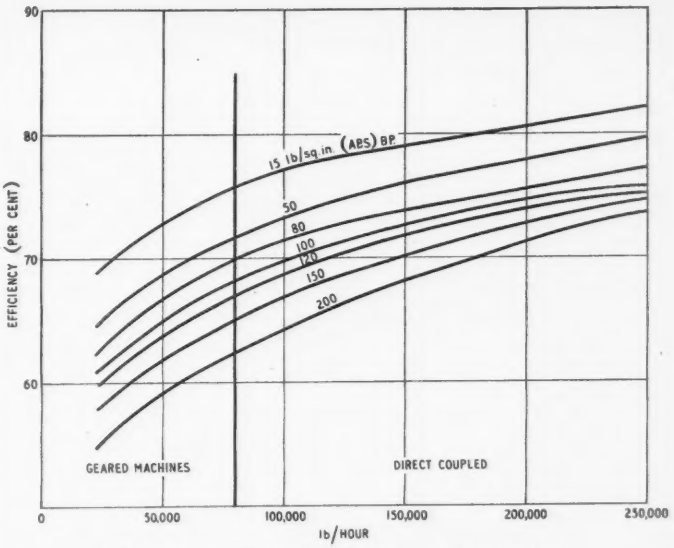
Annual credit for back pressure generation at different steam pressures and quantities for a process steam demand at 100 lb/sq in



A comparison of steam quantities and kW output for throttle (full admission) and nozzle controlled turbines

boilers the travelling chain grate is almost universally accepted. It can deal with a wide range of fuels from the high volatile coking coal to fine coke breeze. The average annual boiler outage is generally sufficient for maintenance of the grate itself and replacements are not a heavy annual expense. Firing rates per sq ft of grate or per cu ft of combustion chamber must be chosen according to the fuel characteristics to be just within the limits, are necessary to avoid excessive fly ash, slag deposits on the boiler tubes or incomplete combustion at the rear end of the grate.

Underfeed stokers are more suitable for the smaller size of boiler of up to 10,000 lb/hr. The combustion efficiency is at the peak only at certain specified loads. Outside this operating range firebed thickness is uneven, air distribution is unequal, and the flue gas loss is high. These stokers are particularly smokeless, even up to firing rates of 30-40 lb/sq ft per hour, but some difficulties in operation are encountered by reason of the high temperature distillation of the ash, with subsequent bonding in the cooler parts of the boiler circuit.



Relationship between steam throughput and turbine efficiency

Pulverized fuel firing suits a wide range of volatile and ash contents, and its flexibility makes it particularly suitable for fluctuating steam demands. The grit arresting plant requires careful design and layout, as it will handle approximately 50 per cent of the original ash in the fuel.

There are a multiplicity of types of oil and gas burners to choose from with claims to higher efficiency or smaller space. In mixed fuel firing the combination burner gives an easier plant layout by the simplification of the air distribution ducting. An interesting development as a result of gas turbine research is the burner which produces constant flame length through a wide range of loads. From the aspect of boiler design, this simplifies the steam temperature control system, as the ratio of heat absorbed in the boiler and superheater surface remains substantially constant.

A new form of turbulent gas burner produces a high frequency pulsating flame. These minute pulsations are transmitted to the boiler heating surface, effectively breaking up the film of inert gas, which is such a barrier to high rates of heat transfer by convection.

The power drives of auxiliary plant such as fans and pumps must in such schemes be chosen to give the necessary degree of mechanical reliability, thermal efficiency, and the necessary speed range. The use of small back pressure turbines for these auxiliary drives is an attractive possibility, where there is a demand for l.p. steam.

Turbine Plant

The distinguishing feature of pass-out and back pressure turbines is the control equipment, which combines a speed governor for the regulation of the inlet steam to the turbine, and a pressure regulator at the pass-out point. The pressure governor operates in such a manner that all steam entering the high-pressure stages of the turbine can either be bled off at the pressure required, or it can continue to expand in the lower pressure stages to the exhaust. Combined systems of this type operate in the following manner:—A variation in the process steam demand results in corresponding pressure changes at the pass-out point. These pressure variations operating through relays cause more or less steam to be admitted to the low-pressure stages of the turbine. This change in the steam throughput of the turbine, however, also causes a variation in the electrical output, but the speed controller compensating for this change brings the electrical output back to its original amount. It is usual to connect these two controls together, in such a manner that partial compensation of the speed control occurs during changes of the pressure control. This is in order to restrict hunting between the controls with subsequent variations in the steam and electrical output.

Size and Efficiency

The efficiency of these small turbines as compared with the ideal cycle efficiency is capable of wide variations, and it is approximately true that the smaller the turbine, the lower will be the efficiency. Firstly, this is on account of the ratio between blade tip leakage, which is substantially constant compared with the volume of steam passing through the blades. Thus a comparatively large turbine using a small weight of steam at low pressure and large volume will show a considerably higher efficiency than a machine which uses the same weight of steam at high pressure.

Within the blades, steam velocity depends entirely on the stage volume, which can be taken, for all practical purposes, as being the correct basis for determining the work per unit of steam.

Steam admission to the first stage of the turbine can be controlled by either throttle or nozzle control. Throttle control consists of a single valve regulating the steam supply to a circumferential nozzle block. This full admission steam entry at the correct steam/wheel velocities can produce the highest possible efficiency, but a drop in steam throughout, caused by load reductions, decreases the overall efficiency rapidly.

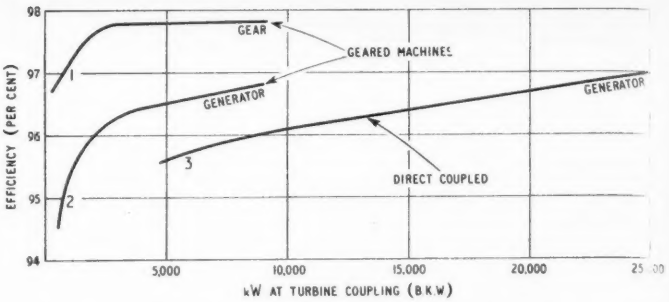
In the nozzle control system, steam is admitted through three or four control valves, which open progressively with increasing load. Each control valve is connected to a segmental orifice block, ensuring that under a wide range of loads the steam velocity in the nozzle blades is maintained somewhere near optimum conditions. The respective efficiencies are compared in the accompanying curves. For power schemes, where it is anticipated that there will be a wide swing in load or steam requirements nozzle control will undoubtedly result in obtaining a higher overall efficiency.

It is also possible to include in the governing system

suitable relays, which will vary the steam supply to the turbine, according to the inlet steam pressure. This is particularly useful when the steam supply is controlled by external factors, such as the operation of waste heat boilers, and will maintain this inlet steam pressure within very narrow limits.

Speed operated trips are usually included with inlet pressure governing, so that in the event of a rise or fall in the turbine speed, beyond a predetermined value they will change the governing system over to conventional speed governing. This is essential if the alternator is ever likely to become through power circuit failures the only power producing unit for a particular load. It can be seen that if the turbine continues to operate on pressure governing during this period, either the electrical requirements will not be met or the speed will rise to the point at which the overspeed trip will operate.

There can be no denying that the gas turbine has come to stay as a prime mover with the oil engine and the steam turbine. It is idle to suppose that it will completely supplant the steam turbine, but there are certain specialized applications, which eminently suit some power and steam linkage schemes. The merits and demerits of the gas turbine are well known, but in the present state of development, it is difficult to avoid stressing the theoretical advantages and minimizing the practical difficulties.

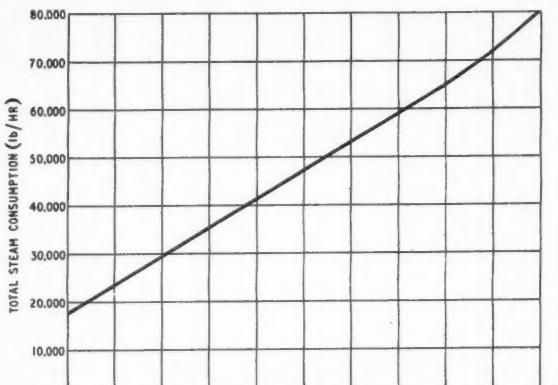


Efficiency ratios for different loads for (1) reduction gearbox; (2) gear driven alternator; and (3) direct coupled alternator

The two factors which seem to require the most attention are long-term data on the behaviour of metals at elevated temperatures, and the development of satisfactory combustion of heavy fuels. The former information cannot be hurried, since the final answer can only be determined after a suitable period of actual running experience.

Extensive development of the aircraft gas turbine has led to the rapid development of very high temperature alloys, but although there is reason to believe that short-term behaviour could be extended to long-term behaviour at somewhat reduced temperature stress conditions, the combustion of heavy fuel oil and pulverized fuel is necessary to compensate for the lower thermal efficiency of the gas turbine in the simpler cycles. The problem of the combustion of low grade fuels is not only that of itself, but must also include the somewhat considerable difficulty of minimizing the effects of deposits and erosion in the turbine and heat exchanger.

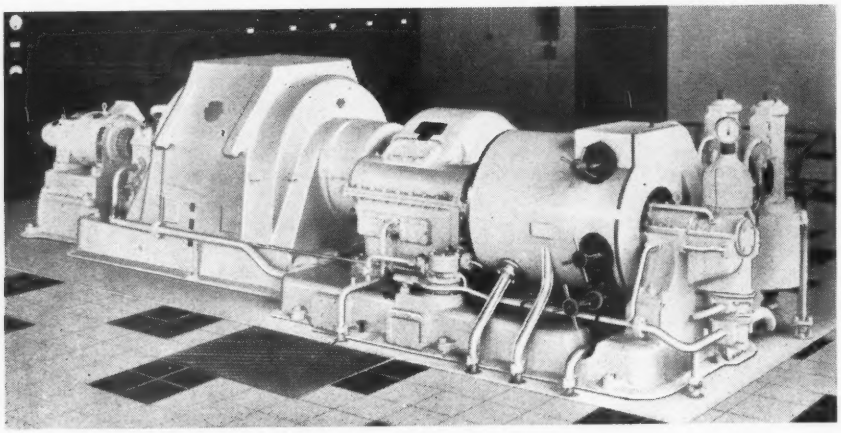
The steam turbine and reciprocating engine have had a practical development life of around 50 years in reaching the present day stage of development. It can confidently be predicted that considering the progress made by the gas turbine, it will be competing with these prime movers on equal terms, within another 10 years.



Steam consumption curve of the 2,000 kW back pressure turbo alternator illustrated below

Generating Plant

The type of generator driven by the turbine can consist of either of the following:—Synchronous alternators, asynchronous alternators, self-excited asynchronous generators, or d.c. generators. The synchronous alternator is the conventional independently excited alternator such as is common in the larger power stations. It requires skilled operation for synchronizing and also skilled maintenance for the exciter, slip-rings, and protection. An additional useful feature of this generator is the large measure of power factor correction which it affords.



The asynchronous alternator is nothing more than an induction motor, driven by the turbine plant. As can be imagined it is of particularly robust construction, having neither exciter nor slip-rings. It also presents little difficulty in switching in, as if the circuit-breaker closes somewhere near normal no-load operating speed there is very little shock to the system.

This type, however, suffers from two great disadvantages: no power factor correction can be carried out, and what is worse, from the small users' point of view, is that these machines rely on external supplies to maintain their self-excitation, i.e. in cases of a failure of the outside supply this alternator immediately stops generating.

Self-excited asynchronous generators have the advantages of requiring no synchronizing equipment and being self-supporting in the case of outside power failures. The d.c. generator finds limited application under present-day circumstances.

It is assumed in all these cases that the alternators will be required to run parallel with imported supplies, but before approval will be given to this form of parallel operation the Board will require to be satisfied on the rupturing capacity of the circuit-breakers installed, the protective system adopted, and the current carrying capacity up to the point of supply. In continuous industry the expected availability of boiler and generating plant becomes an important item, and the assessment of this total down time in relation to plant outputs is useful. As some guide a summary of a plant record from a continuous industry is given in the table below.

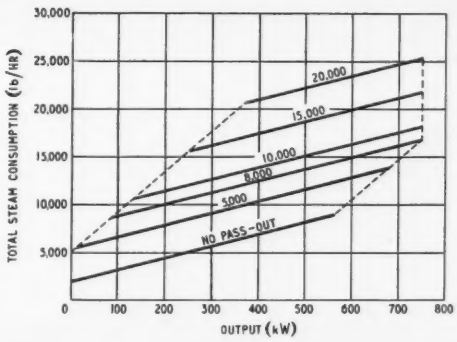
From the foregoing figures it becomes quite clear that stand-by capacity need only be a very small proportion of the total. Even in the worst case of the stoker fired boilers, more than an additional one boiler in twenty cannot be justified, and if excess stand-by capacity is installed it merely represents idle capital. To cover such short periods of down time, it is preferable to increase plant loadings from their normal economic rating to their maximum.

The overall labour shortage brings into prominence the need to design for minimum manning requirements. A continuous duty such as pump operation requires four men totalling £2,000 per annum, which is increased to £3,000 per annum by sickness, insurance, management, etc. This sum capitalized even over a five-year period is equivalent to £15,000, which can be spent in these days of acute labour shortage to make this particular job unmanned and automatic.

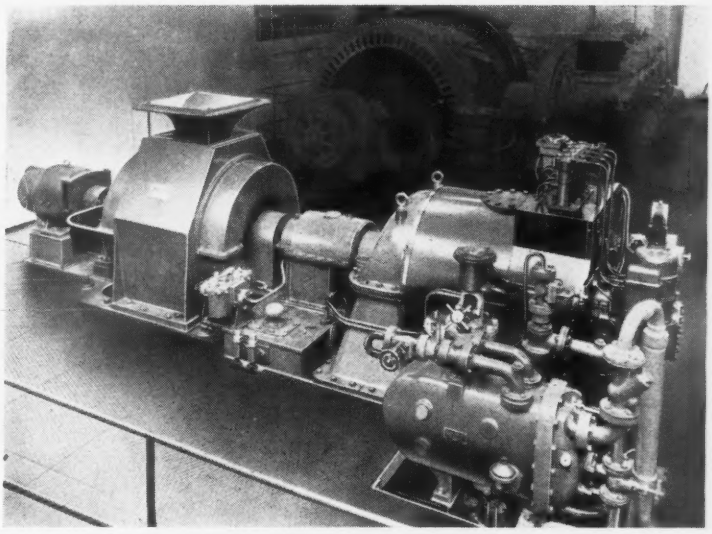
The operation of any turbine/boiler plant requires a varying degree of technical competence. Further, there must be active co-operation on the part of the management in supplying suitable trained persons to operate and supervise such schemes. It is regrettable, but nevertheless true, that there are many smaller managements who are quite unsympathetic to any plant improvement schemes, and many are the specious arguments used to explain away the non-adoption of any of these schemes. I see no easy solution to this aspect of the problem except that in course of time these uneconomic managements will be replaced by more progressive and enlightened boards.

There are also still far too many small factories, where the standard of technical education is insufficiently high to operate any advanced type of plant with the necessary technical skill, which in these days must keep pace with the complexities and pressures now advocated. The national policy of increased training and education facilities should be pursued with the utmost vigour and, wherever possible, should be financially encouraged. The average plant operator does not take too kindly to advanced training, if the only benefit is to be in the "national interest." Some form of additional payment is probably the best incentive to ensure a widespread demand for technical training, and through this, and a policy of evolution, we may ultimately achieve compulsory certification for all boiler and turbine operators.

The preparation of a heat and power scheme must take into account the technical and operating requirements of the engineers, the administrative functions of the management and, possibly more important to-day, the financial angle of the accountants. The scheme, as a whole, must show in detail its annual financial return costed on a completely realistic basis. It is usual to find that such items as waste heat and waste gaseous fuel, although they cannot be stored or sold externally, must be credited at the equivalent cost per B.Th.U. of the solid and liquid



Steam consumption curves of the 750 kW pass-out condensing turbo alternator illustrated below



Plant Item	Annual Outages	Per cent
Gas and oil fired boilers	Pressure parts	1·0
	Refractories	2·5
	Fuel firing equipment	0·2
Turbo-alternator plant	Turbines	0·5
	Alternator windings	0·2
	Brushgear slip-rings and commutators	1·2
	Condensing plant	2·5
..P. boiler plant	Pressure parts and valves	1·0
	Stokers and refractories	5·5

fuel prices. The operating life of a boiler and turbine plant is generally estimated as giving 20 years' service. The annual operating cost of the boiler unit should therefore include the interest charges on the original capital, and a suitable allowance to cover obsolescence and depreciation. These two items in a normal competitive industry will total approximately 12½ per cent of the original capital cost.

It is also true to state that when schemes are being prepared, any extra plant above the bare minimum requirements must be capable of showing an annual profit from its incorporation, roughly equivalent to the prevailing rate of profit of that industry itself.

Smaller industries will be greatly assisted in the search for new capital by the State-aided scheme now being offered, but it may be later found necessary to offer further financial inducements or even some measure of compulsion, to achieve a uniformly high level of fuel utilization.

It is apparent that there is sufficient technical ability already in this country capable of producing very quickly schemes for the more efficient use of fuel. Further, British manufacturers are in the position to supply plant corresponding to these schemes. It is a debatable point whether the time is now opportune to introduce some degree of compulsion to be directed principally against non-co-operative managements, in a similar manner to that employed in France. A fuel crisis is already with us, and I am convinced that we can and will overcome it.

Electric Traction at Power Frequency

THE discussion on the paper entitled " The Potentialities of Railway Electrification at the Standard Frequency," which was presented before the Institution of Electrical Engineers on 2nd February and reported in our last issue, was opened by Mr. C. M. Cock (English Electric Co.). It was becoming increasingly evident, he said, that the d.c. rectifier-fed motor would be the best for standard frequency electrification. For an overseas project investigated recently for 400 route miles of single track with a traffic density of 6 million trailing-ton miles per mile of single track per annum, the annual costs of the d.c. and standard frequency systems were as 105 to 100, compared with the authors' figures of 112 to 100, while if cabling telecommunication circuits was taken into account the difference was negligible. An a.c. Bo-Bo locomotive had been included in the study against a d.c. Co-Co locomotive, but the difference in cost was only 4·5 per cent in favour of the a.c. locomotive. Putting a substation into a Bo-Bo locomotive absorbed a large part of the savings obtained in other ways.

Mr. S. B. Warder (British Transport Commission) said that, as a result of the Lancaster-Heysham experiment and developments on the Continent, the British Transport Commission had studied the whole question of electrification anew. The paper put the subject into proper perspective. Inter-running between a.c. and d.c. systems was not worth the trouble. A third-rail system was convenient if confined to multiple-unit passenger trains in a permanently restricted area, but the Southern system must be extended to Dover and Ramsgate to secure the full benefits of the existing installation. A third-rail system, if retained, must remain independent. For locomotives, he agreed, the rectifier offered the best solution available at present. On telecommunication interference he agreed with the authors; modern conditions demanded cables. The B.T.C. would shortly publish a booklet explaining the reasons for its proposed developments.

M. Gastine (French Railways) referred to two important French electrifications not mentioned in the paper. The first, " Nord-Paris," consisting mainly of the Paris-Lille line (550km) and requiring about 100 locomotives, which would be put into operation within two years. The second, " Est-Paris," including the main line from Paris to Nancy, (660km), would require some 150 locomotives. The total length of route then electrified at standard frequency would be 2,450km, compared with 4,200km at 1,500 V d.c.

Experience on the Valenciennes-Thionville line had proved the excellent performance of ignitron locomotives and shown the fears of trouble from current harmonics to be groundless. The new electrifications would therefore have, almost exclusively, Bo-Bo rectifier locomotives with ignitrons or excitrons. The excellent adhesion qualities obtained had led to the design of a lightweight Bo-Bo locomotive, weighing less than 60 tons, which could haul 550-ton express trains on the level at 120 km per hour and 1,350-ton goods trains on 8·8 per cent gradients. Future locomotives for the Nord-Paris and Est-Paris routes would be almost all of this type. They were studying 50 c/s multiple units for suburban service using the mechanical parts of existing 1,500 V d.c. multiple units.

Mr. O. J. Crompton (B.I.C.C.), pointed out that the costs of overhead equipment given in Fig. 4 of the paper were based on copper at £285/ton and on single-track open-route main line. With double track, he said, the a.c. costs but not the d.c. costs would be doubled; for the heavier equipment a portal structure would be cheaper than two cantilevers. Moreover, a scheme in this country would include some terminal stations and large junctions, where the margin between a.c. and d.c. would be much smaller. For high speeds, automatic tensioning would be necessary for a.c. equipment but not for the heavier d.c. equipment. The margin in favour of a.c., therefore, would be much smaller in this country than the authors' figures suggested.

Mr. F. J. Lane (C.E.A.) said that the use of 25 kV would require a transformer between the supply system and the railway system. If the railway load were taken off the same busbar as an Area Board commercial load, the fluctuations due to the former would affect the commercial load system, and the taking of a single-phase load from a three-phase system would produce an unbalanced voltage drop. A load of this type should not be directly associated with busbars giving a normal supply. He showed diagrammatically a supply arrangement by which voltage drop effect, flicker effect and the impact of fluctuating load could be largely removed from the normal commercial load. The 25 kV supply would be given by direct single-phase transformation from two phases of the 132 kV system, the single-phase transformers being banked on the 132 kV side with three-phase transformers supplying the distribution board.

Mr. F. Whyman (Metropolitan-Vickers) considered that to design for a 20 per cent voltage drop was unnecessary and instanced some 3,000 V equipment supplied for a d.c. system which was being changed over from 1,500 to 3,000 V. This had run for some months quite sati-

factorily on 1,500 V, in spite of ups and downs of considerably more than 20 per cent on the 1,500 V system.

Mr. A. W. Manser (London Transport) pointed out, in regard to the maintenance of dual systems of rolling stock equipment, that the more components that were put into a vehicle the less reliable it became. He believed it would be worth paying £5,000 per mile to get rid of the need for dual equipment.

Mr. W. B. G. Collis (B.T.H.) suggested that the effect of commutation ripple from rectifiers mounted on rolling stock might well be over-estimated; although the amplitude might be 20 per cent on the rectifier the intervening transformer would reduce this to less than 2 per cent on the line. The main problem would therefore be to limit harmonic interference, and more might be done at the source by still further reducing the amount of smoothing on the d.c. side in the traction circuit.

Mr. C. C. Inglis (British Transport Commission) invited the authors' comments on the relative reliability of a.c. and d.c. locomotives.

Dr. J. M. Kay (Kennedy & Donkin) said that the most remarkable result of the French demonstration had been the haulage capacity of relatively small Bo-Bo rectifier locomotives. A mixed-traffic Bo-Bo rectifier locomotive of 1,800 to 2,000 h.p. would meet nearly all the traffic requirements of British Railways, though for heavy freight traffic on a steeply-graded line a rotary convertor type had certain advantages, particularly with regard to regenerative braking. In this country the saving on fixed equipment with the 50 c/s system might be largely offset by higher civil engineering costs, and its main advantage might be the superior hauling capacity and starting performance of 50 c/s rectifier locomotives.

Mr. J. H. R. Nixon (Brush Electrical Engineering Co.) suggested that supplementary studies were required, which should include a detailed and critical study of the different types of locomotive. The question also arose whether, if standard frequency electrification could be introduced throughout this country tomorrow, the power resources could cope with it.

Mr. D. B. Hogg said that the costs finally produced by the authors showed a difference of only 12½ per cent between the middle and the top and the middle and the bottom. Running conditions and market changes might falsify the original data by more than 12½ per cent, and a variation of 35 per cent was desirable.

Nuclear Reactor Engineering

IN a paper presented before the North East Coast Institution of Engineers and Shipbuilders recently, Mr. C. E. Iliffe (U.K. Atomic Energy Authority) described nuclear reactors for power generation that might be used in the near future. These, he stated, would probably be confined to heterogeneous thermal-neutron types using moderators of heavy or light water or graphite and cooled by either of the two kinds of water or gas or sodium. Water-cooled reactors could employ either pressurized or boiling systems. In the first, the coolant pressure (e.g. 2,000 lb/sq in) was below the corresponding saturation temperature (636 deg F), so that boiling was suppressed; steam conditions on the secondary (power cycle) side of the heat exchanger were about 600 lb/sq in and 486 deg F. In the second system the coolant was boiled in a vertical core and fed to the steam power plant directly; pumping power was less and the heat exchanger was eliminated, but precautions against leakage of radioactive steam were necessary.

Heavy water had the great advantage of requiring natural uranium alone, but it was very costly. The volume ratio of moderator to fuel was about 20 to 1, facilitating the disposal of fuel within the core. Loss of coolant might result in rapid rise in reactivity and hence in heat, which could be destructive. For the light water reactor, this volume ratio was 2 or 3 to 1, resulting in a reduction in diameter which, however, necessitated a 30 per cent enrichment of fuel.

The pressurized system was more practicable with light than with heavy water, but there was no fundamental difference, apart from size and the design and arrangement of the fuel elements, between boiling reactors of either type. Nor need there be any appreciable disparity between the design and arrangement of fuel elements in a light water reactor of the boiling and pressurized systems.

Proposals for a water-cooled graphite-moderated reactor had been put forward in the U.S.A. This might be fuelled with uranium containing 0.92 per cent U235 uniformly distributed in a magnesium alloy. The cooling water, which would enter the reactor at 485 deg F and leave at 585 deg F, would be maintained at 1,860 lb/sq in abs., the corresponding saturation temperature being 626 deg F.

The gas-cooled graphite-moderated reactor, as used at Calder Hall power station (which was described in the *Electrical Review* of 25th November, 1955), operated with natural uranium. Carbon dioxide, which was used as coolant at 200 lb/sq in, was relatively cheap and possessed suitable nuclear properties. Unlike water its top temperature was not limited by its pressure but could be increased to the maximum permitted by the material of the fuel element.

In the sodium-graphite reactor water or gas as coolant was replaced by sodium, which enabled high power outputs to be obtained without pressurization. The boiling point of sodium being 1,587 deg F, no limitation was imposed on coolant temperature by the sodium, so heat could be transferred from the reactor at a temperature limited only by metallurgical considerations. Sodium had a marked chemical reaction with water and oxidised rapidly in air. It became highly radioactive and the primary coolant system had to be shielded. Loss of coolant would be accompanied by a rise in reactivity of the core. Contact between sodium and graphite must be avoided to preserve the moderator value.

After consideration of certain thermodynamic aspects (including upper temperatures feasible) and their effect on steam turbine performance, an economic comparison was drawn up of four types of reactor. These showed at 0.8 load factor the following costs in pence per kWh sent out:—Capital charges (interest 4 per cent): heavy water, boiling, 0.433; light water, boiling, 0.403; gas cooled, graphite, 0.358; sodium, graphite, 0.312. Corresponding running costs: 0.250; 0.261; 0.311; 0.288. Total costs thus became: 0.683; 0.664; 0.669; 0.600. It was emphasized that these figures were based on design studies only. Costs per kWh sent out from a modern coal fired station at a high load factor were taken as: fuel (including handling), 0.38d; capital and other charges 0.22d; total 0.60d.

District Heating in Pimlico

ECONOMICS OF SCHEME DISCUSSED

THE discussion at the joint meeting of the Institutions of Civil and Electrical Engineers on the paper on the Pimlico district heating undertaking which was summarized in the *Electrical Review* last week was opened by Mr. W. B. Noddings (commercial manager, C.E.A.). Figures given in the paper, he said, indicated an overall efficiency of conversion (the energy supplied by electricity and heat related to the heat input in the coal) of about 80 per cent. The corresponding figure if the two supplies were derived independently would be about 55 per cent. The coal saving when the scheme was in full operation would be something over 4,500 tons per annum for a total capital cost of £430,000, which meant a capital expenditure of £90 to save one ton of coal per annum. The Anglo-American Productivity Council had estimated that conversion of all the hand-fired boilers in Britain to mechanical firing would save 3½ million tons of coal for an expenditure of £12 million, which meant spending £4 to save one ton of coal per annum. It was clear, therefore, that money could be used to better advantage than in combined generation if it were only a question of coal saving.

The average figure of heat supplied was 640 therms per annum per flat at a cost to the tenant of £30 per annum. A social survey had shown that households of the same average size spent about £23 per annum on raw fuel, gas and electricity taken together. On the Continent, domestic district heating was usually confined to flats occupied by the higher income groups and was only a small adjunct to the supplying of commercial blocks and public buildings. In this country people were less " flat-minded " than people on the Continent, and those who could afford the standard of comfort necessary for successful district heating were unlikely to want to live in the immediate vicinity of power stations. The prospects of any major developments of domestic district heating on the lines of the Pimlico scheme seemed therefore limited.

Mr. H. S. Horsman (efficiency and testing engineer, C.E.A.) suggested that it would be desirable to envisage supplying 6,000 to 10,000 dwellings instead of 3,000. Larger and therefore more efficient back-pressure sets could then be especially designed for the job. Instead of discharging at a back pressure of 17 lb/sq in abs. there should be a vacuum of several inches Hg because the number of kWh per therm would then go up; this was important because the income from a given quantity of heat in the form of electricity was about six times the income from the same quantity of heat transferred to hot water for domestic heating.

Mr. V. G. Newman (generation design dept., C.E.A.) said that the theoretical case for the heat accumulator rested on the fact that the capital cost per kW of installed generator capacity was higher for back-pressure than for condensing plant, so that the fixed charges on the heat-electric plant were higher than the fixed value of the kilowatt output. It followed that the cost of heat at the turbine exhaust would be least when the capacity of the heat-supply plant was at the minimum, which meant that the load factor on the heat-supply plant should be as high as possible. That condition could be achieved with the heat accumulator by sizing the heat-electric plant so that it was just capable of supplying the heat demand on the coldest day when operating continuously for 24 hours on full output.

He had estimated that the accumulator would save £26,000 in the capital cost and £9,000 per annum in annual costs. Why, then, did the heat accumulator seem to be passing into disfavour on the Continent?

Mr. D. J. Bolton referred to the 37 per cent of the overall cost that was spent in taking the heat the half-mile from Battersea to the housing estates. The proportion would be much higher in a less concentrated load area. Looking ahead, the future seemed to lie with schemes having firm kW value rather than with those with "run-of-river " characteristics. In relation to the return on capital, the dual heat and electricity supply was not an economic way of saving coal, but it might be if there were a kilowatt saving as well. In the atomic-energy future it might be more important for the remaining coal-fired stations to produce kilowatts at the right moment of the day and year than merely to save coal.

Mr. C. G. Carrothers (Kennedy & Donkin) said that at present there was a tendency in Continental schemes to use pass-out rather than back-pressure turbines. There was not the same saving in capital by the use of an accumulator, because usually the pass-out sets were very large, operating partly condensing, and the alteration in their size by omitting the accumulator would be insignificant. That accounted almost wholly for the loss of favour of the accumulator on the Continent.

Mr. C. L. Champion (Ministry of Works) deplored the fact that the Pimlico type of installation was unique in this country, and that no other comparable installation appeared to be following it up. Many considerable local authority housing estates had been provided with electric heating, only, at about three times the cost. Heating on the Pimlico scale represented a very real increase in the standard of living and it was therefore most important that the charges should be the full cost and not contain any element of subsidy.

In reply to the discussion, Mr. E. Ockenden (one of the authors) stated that the tenants seemed to find no real difficulty in meeting the charges. The policy was that the income in respect of the scheme should over a period equal the expenditure. His Council was concerned at the high cost of the distribution system, which had amounted to 23 per cent of its expenditure.

Strength Testing of Timber

THE Department of Scientific and Industrial Research has recently published Forest Products Research Bulletin No. 34 " The Strength Properties of Timber." It is available from H.M. Stationery Office, price 2s. 6d.

The original standard for testing timber introduced over 50 years ago and adopted by all the English-speaking timber-testing countries is based on the use of test pieces of 2in square cross-section. Many Continental countries, however, use a testing system which involves test pieces of 2cm cross-section. This scheme is more suitable for the sampling of small and second growth trees and for the preparation of matched groups of test specimens for all comparative tests. Data from tests on twenty-nine hardwoods and twelve softwoods are given, and diagrams are included which provide a comparison of the results obtained with different species.

VIEWS on the NEWS

By REFLECTOR

INDEPENDENCE of England in the matter of electricity supply has enabled the South of Scotland Electricity Board to undertake not to increase its charges this year. Its announcement has naturally raised questions in England where people fail to understand why the Electricity Boards here cannot follow the Scottish example. It should be made clear to them that the English Boards have been instructed to raise their prices, largely in order to finance capital developments from revenue, a course which, it may be recalled, was not approved by the Herbert Committee. Still it must be said that this Committee expressed the opinion that domestic consumers should pay more for their electricity.

* * *

Uniforms for meter readers are really desirable when so many rogues are gaining entry to houses on the pretext that they have come to read the meter. It seems that the North Western Gas Board is endeavouring to secure uniformity in uniforms and the *Manchester Guardian* reports an occasion at which a new design was displayed. It is said that the new uniform is " a field-grey affair which makes them [the meter readers] look like policemen from a darkly Ruritanian State". There were complaints from some readers that the uniform had an insufficient supply of pockets, but the chairman of the Board replied in effect: " all the fewer to stuff with unnecessary paraphernalia thus spoiling the line." One section objected to the peaked cap, one of them saying that a bowler hat was more authoritative; he did not want people to confuse meter readers with bus conductors and postmen—which sounds a trifle superior.

* * *

In its leading article for December the *Heat Exchanger* (a journal published in Bombay) says:—

> " Hitherto the suggestion has been abroad that air-conditioning comfort is intended only for the select few, while hundreds of people who can really afford this new comfort do not know the economic facts about it. There are hundreds of others too who work hard to own a car, a home, and would undoubtedly work even harder, to have a room air conditioner, if they knew how much it was going to cost them."

It seems to me that the harder they work the more air conditioning they will need.

* * *

Occasionally I see or hear of a new postage stamp commemorating some electrical or radio event but I did not realize that there had been so many issues of this kind until I saw recently a book on the subject produced in the United States. Although this publication deals mainly with radio, television and telecommunications, among the 500 or so stamps listed, and largely illustrated, are many of a purely electrical character such as those commemorating the invention of the incandescent lamp (by Edison, of course), and others relating to the founders of electrical science—Volta, Ampère, Gauss, Gramme, etc. The book " Radio-Philatelia " is by Herbert Rosen and is published by the Audio Master Corporation, 17, East 45th Street, New York, 17, at $2.

* * *

Some British manufacturers have had experience of the operation of the " Buy American " Act by which United States firms are given a measure of protection against imports from abroad. An Italian concern, Ansaldo San Giorgio, recently put in the lowest tender for hydro-electric generating plant for the Yakima (Washington) and Provo River (Utah) schemes but its offer was rejected not only because it came within the terms of the " Buy American " Act but also (according to the Milan correspondent of *The Times*) because the majority of the firm's workers belonged to the Communist-controlled Italian General Confederation of Labour. The American State Department contended that the Ansaldo management had made no effort to eliminate this Communist predominance. It seems to me that any firm taking action to ensure that its workers' trade unions were not of a particular political persuasion would find itself with trouble on its hands, however desirable its aim might be. Does the State Department's action presage yet another barrier to international trade?

* * *

The following is an extract from the *Electrical Review* of 19th February, 1886:—

> " Considering the late hour at which the poll at the Newcastle election last week would probably be declared, and the inefficiency of gas illumination in St. Nicholas's Square for such an occasion, the authorities decided to bring the electric light to their aid. The arrangements were placed in the hands of Messrs. J. H. Holmes and Co., electrical engineers, of Newcastle. A portable engine was placed within a wooden structure erected in the Bigg Market, to work two powerful dynamos. Each dynamo worked a large arc lamp, the current being conveyed by wires taken from the dynamos to the top of the Town Hall. The lamps were supported by poles projected from the front cornices of the Town Hall. Each gave a light of 8,000 candle-power, and was so fixed that its light fell immediately on the board placed for receiving the numbers indicating the result of the poll. At a quarter past six the lamps were lighted for a few minutes, and proved completely satisfactory. When they were lighted later on, they threw the gas lights into the shade, and brilliantly illumined the square of upturned faces beneath."

* * *

I am sorry that in my last week's note on cable divining I referred to Mr. D. P. J. Holbrook, of Trinidad, as Mr. D. P. J. Brook.

PERSONAL AND SOCIAL

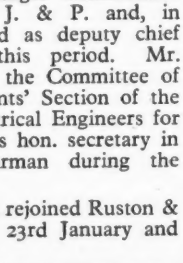
News of Men and Women of the Industry

Sir Charles Westlake, who joined the board of Metal Industries, Ltd., in October, following his retirement from the chairmanship of the Uganda Electricity Board, has accepted the invitation of the board of Metal Industries to take over the chairmanship of the company. **Mr. J. S. Hutchison** has resigned as chairman, and **Mr. J. L. Hardie,** a director, has also resigned.

Johnson & Phillips, Ltd., announce that **Mr. R. V. Darton,** B.Sc.(Eng.), A.M.I.E.E., has been appointed chief designer, Transformer Department. Mr. Darton was educated at Haberdashers' Aske's Hatcham Boys' School and studied engineering at Woolwich Polytechnic as a sandwich course student while receiving his apprentice training at Johnson & Phillips, Ltd. After graduating with honours in 1941 he joined the Transformer Department of the company as an assistant designer, becoming a senior designer in 1944. For some years he has been concerned mainly with the larger transformers manufactured by J. & P. and, in addition, has acted as deputy chief designer during this period. Mr. Darton served on the Committee of the London Students' Section of the Institution of Electrical Engineers for five years. He was hon. secretary in 1945-46 and chairman during the following year.

Mr. R. V. Darton

Mr. K. Wickham rejoined Ruston & Hornsby, Ltd., on 23rd January and has been appointed assistant export manager. He first joined the company in 1929 and after five years of apprenticeship served in both Home and Export Sales Departments. In 1938 he left Lincoln to take up an appointment as assistant mechanical engineer with the company's Ceylon agents, Brown & Co., Ltd., and in 1952 became a director and chief engineer of that company. In his new appointment Mr. Wickham will carry out his responsibilities in conjunction with Mr. G. Anselm and Mr. J. A. Bennett-Powell. Under the authority of Mr. J. H. Albertini, the company's export manager, these three assistant managers will supervise the export organization of Ruston & Hornsby, Ltd., and the associate company, Davey Paxman & Co., Ltd.



Mr. K. Wickham

Mr. A. J. Nicholas, managing director, South Wales Switchgear, Ltd., and **Mr. W. R. Hall,** export manager, Aberdare Cables Ltd., left this country recently on a business trip to India and Pakistan returning *via* the United States and Canada.

The Utilization Group of the North-Western Centre of the **Institution of Electrical Engineers** held its annual dinner-dance at the Embassy Rooms (Locarno), Sale, on 3rd February, some 275 members and guests being received by the chairman, Mr. J. C. Jones, M.I.E.E., and Mrs. Jones. Among those present were Mr. G. V. Sadler, M.I.E.E., chairman of the North-Western Centre, and Mrs. Sadler, and Mr. T. T. Evans, A.M.I.E.E., hon. secretary of the Centre.

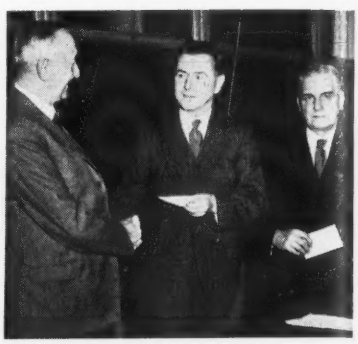
Mr. D. I. Shakespeare has joined Creators, Ltd., Woking, Surrey, as sales manager (domestic division). He was previously sales manager with the Guiterman-Palmer organization.

Sigmund Pumps, Ltd., announces that **Sir Walter James Drummond,** M.I.C.E., M.I.Mech.E., has joined the board. Sir Walter recently resigned his appointment as deputy chairman of the National Coal Board. He has served on the Advisory Council of the Department of Scientific and Industrial Research and on numerous other bodies connected with industry and research.

On 3rd February, Mr. S. Roberts, managing director of **Hoover, Ltd.,** and Mrs. Roberts, together with Mr. B. H. Dyson, general works manager, and Mrs. Dyson, were the hosts and hostesses at the annual supervisory dinner-dance of the company's Perivale and High Wycombe staff. The party was held at the Savoy Hotel, London, and there were over 300 guests.

Presentations were made recently to two long-serving members of the senior staff of Siemens Brothers & Co., Ltd., when Dr. J. N. Aldington, managing director, presented cheques to **Mr. W. E. Goodwin** and **Mr. S. G. Body.**

Mr. Goodwin joined the telephone design section of Siemens Brothers in 1911, and in 1943 became assistant manager of the telecommunications group. He was confirmed as manager of the group in 1952 and in 1954 became manager of the establishment services branch. Since March, 1955, he has been consultant, Siemens group headquarters branch.



Dr. J. N. Aldington, managing director, Siemens Bros. & Co., Ltd. (centre) presenting a cheque to Mr. W. E. Goodwin. On the extreme right is Mr. S. G. Body

Mr. Body joined Siemens Brothers in 1907 in the then head office at Queen Anne's Gate. In 1944 he was appointed head of the telephone cable and battery sales section and since 1953 has been manager of the telephone cable and battery department.

The Metropolitan-Vickers Electrical Co., Ltd., has appointed **Mr. W. C. Clegg** to be assistant puchasing agent. Mr. Clegg was formerly purchasing agent with Ferguson, Pailin, Ltd., having joined that company in 1920. Following an apprenticeship and several years in the company's drawing office, he transferred to the sales engineering staff, and in 1940 he was made chief estimator. He became purchasing agent in 1945 and retained this position until his present appointment.

No fewer than 900 children attended the annual children's Christmas outing on 28th January, organized by the **Telcon Social & Athletic Club.** The children were taken to see "Babes in the Wood" on ice at Wembley, and it required twenty-two coaches to bring the children from Telcon's factories at Greenwich, Erith, Farnborough and Crawley. Mr. L. R. Letton, hon. secretary to the club, and his Committee, were responsible for the organization.

Some 350 children of employees of the **Rheostatic Co., Ltd.,** were recently taken to Earls Court to see "Dick Whittington on Ice." Besides the main contingent from Slough, parties came from Frimley and Farnham, Surrey, where the company has branch works. This outing was for children

from five to fifteen years old, and over 100 younger ones under five received Christmas presents of toys and games.

Mr. J. MacKenzie Mitchell B.Sc.(Eng.), A.M.I.Mech.E. has been appointed chief engineer, Turbine Department, at the Fraser & Chalmers Engineering Works of the General Electric Co., Ltd., at Erith, Kent. Mr. Mitchell began his career with the company in 1940 and served a craft apprenticeship, obtaining his degree at the University of London with first class honours and a royal scholarship in science. He was awarded the diploma of the Imperial College of Science & Technology after a year's post-graduate course at the City & Guilds College.

Mr. C. O. Boyse has been appointed a director of the Automatic Telephone & Electric Co.,Ltd. It is proposed at the next annual meeting to increase the number of directors permitted in the Articles from nine to twelve and then to appoint to the board **Mr. G.D. Christie** and **Mr. F. O. Morrell.**

Mr. E. J. Emery, M.Brit.I.R.E., M.I.R.E., who has been appointed a director on the main board of Electric & Musical Industries, Ltd., is well known throughout the radio industry as managing director of E.M.I. Sales & Service, Ltd. He joined the Marconi Co. late in 1916 and as a wireless officer travelled to many parts of the world. In 1922 he transferred to the Marconiphone Co. on the inception of radio broadcasting. Since then he has held many responsible positions in the E.M.I. group. Mr. Emery has played a leading part in initiating and promoting technical and service training schemes for the radio and television industries; he has been chairman of the City & Guilds Advisory Committee on Radio and Television since its formation before the war, and he is also chairman of the Radio Trades Examination Board.

Mr. E.J. Emery.

Sir Harold Spencer Jones, K.B.E., F.R.S., who recently retired from the position of Astronomer Royal, has joined the Smiths Group of Companies in a consultancy capacity.

Mr. W. J. Darby, lately group managing director of Lewis Berger & Co., Ltd., has joined the board of Thorn Electrical Industries, Ltd. Mr. Darby has just returned to this country from an extensive tour of the United States and the Far East.

On 8th February a party of 56 television and radio equipment salesmen from all parts of the United States arrived at London Airport on the first stage of an 18-day tour of the world. This tour, which has the endorsement of the State & Commerce Department of the United States as a force for international harmony and understanding, is the prize awarded to the winners of nationwide retail sales competition organised by the **Philco Corporation of Philadelphia.** The salesmen spent two days in London, and after a coach tour attended a reception at Grosvenor House where they were welcomed to this country by the American Ambassador. They left for Paris on 10th February accompanied by Mr. F. Willard, vice-president of the Philco International Corporation.

The annual dinner and dance of **Southern United Telephone Cables, Ltd.,** was held on Friday last at the May Fair Hotel, London, Sir John Dalton (chairman), presiding over a large gathering. Mr. A. F. Lampitt, in proposing the toast of the company, paid tribute to the late Mr. W. F. Bishop, former chairman of the company, and welcomed Sir John on his first attendance at the dinner as chairman. He spoke of the many appointments which Sir John held in the electrical industry and congratulated him on becoming president this year of the British Electrical Power Convention. He said that the company's output last year had been a record, and he expressed the staff's appreciation of the improvements which had been made in the pension scheme.

Sir John in reply, referred to the gathering as a party, and his witty speech was made in the party spirit. He mentioned that Mr. Lampitt had that week been elected to the board of the company (an announcement that was received with acclamation), and said that he and his colleagues on the board thanked everyone at Dagenham for their contribution to a record year. The toast to the guests was proposed by Mr. W. A. Mackenzie, and the response was made by Mr. C. H. I. Chown.

The **ex-Johnson & Phillips Association** is holding its annual reunion dinner on 3rd March at Grosvenor House, Park Lane, W.1. During the afternoon of that day a visit to the Charlton Works of Johnson & Phillips is also planned. Past members of the J. & P. staff, who are not members of the Association, and would like to attend the dinner, are invited to write for particulars to Mr. S. W. Foakes, hon. secretary, ex-J. & P. Association, 22, Madison Gardens, Bexleyheath Kent.

M.K. Electric, Ltd., held a dance on 3rd February at the Assembly Hall, Walthamstow, at which long-service awards were presented to employees; nearly seven hundred guests attended. The presentation ceremony was presided over by Mr. C. L. Arnold, founder director and general manager. Employees who had completed 25 years' continuous service received gold watches, and Mrs. Arnold made the presentations.

Mr. A. J. Baggott, A.M.I.E.E., who writes in this issue on "A New Test Set for Installation Inspectors," received his technical education at the Walsall and Birmingham Technical Colleges. His early training was with the Walsall Electricity Department, after which, up to the outbreak of war, he was engaged in lecturing at the Walsall Technical College.

Mr. A. J. Baggott

In January, 1940, he was seconded to D.S.I.R., Admiralty, and as an experimental officer was engaged on research and development of underwater weapons. Two separate awards were made to him after the war for original work in this connection.

After the war Mr. Baggott wrote a paper on magnetic and acoustic mines which was accepted by the I.E.E. and jointly with C. H. Fawcett an award of the "Webber Memorial" was made for this work.

In 1946 he moved to the Bromley Electricity Department and was employed as first assistant consumers' engineer and later as first assistant mains engineer. After nationalization he was appointed as meter and test superintendent of the Southern Sub-Area of the London Electricity Board.

OBITUARY

Mr. A. C. Cramb.—It is with regret that we have to record the death, which occurred on 10th February, of Mr. Alexander Charles Cramb, M.I.E.E., M.I.Mech.E., who was well known throughout the electrical industry as chief engineer and manager of the Croydon Corporation electricity undertaking, for his activities in connection with the Incorporated Municipal Electrical Association, and from 1930 until his retirement in 1943 as director and secretary of the British Electrical Development Association.

The late Mr. A. C. Cramb

Mr. Cramb, who was eighty-one, commenced his career in the electricity supply industry towards the end of the last century when he occupied posts at Islington, Huddersfield and Hampstead. He went to Croydon in 1902 as chief assistant and two years later became chief engineer and

manager; he also acted in an advisory capacity to the Tramways Department. During the 1914-18 war he was district engineer to the Metropolitan Munitions Board and in that position he was responsible for the production of large quantities of war material. His activities in connection with the I.M.E.A. made him a well-known figure in electricity supply circles. He was president of the Association in 1916-17 and after serving as hon. treasurer became hon. secretary in 1919, in which position he was responsible for organizing a number of successful annual conventions. He was a member of the Committee set up by the Electricity Commissioners in 1925 to advise them upon the subject of domestic supplies and of the Commissioners' Committees on uniformity of systems and tariffs which reported in 1930. He was an advocate of appliance-selling powers for municipal authorities and became a member of "Committee D" appointed to deal with this matter under Clause 48 of the 1926 Electricity (Supply) Act.

Mr. Cramb was connected with E.D.A. from its inception. He served on the Council and Executive Committee for some years and was chairman in 1928. He succeeded Lt.-Col. W. A. Vignoles as director and secretary in 1930. His period of service with the E.D.A. was marked by a tremendous increase in the Association's activities and an equally great increase in the influence of the Association in national affairs.

Among his many other activities, Mr. Cramb was a past-president of the Association of Public Lighting Engineers and he had served on the Councils of the I.E.E., the British Standards Institution and the E.R.A.

Mr. T. D. Ratcliffe, who was well known for many years in the electricity supply industry in London and the Home Counties as a representative of W. T. Henley's Telegraph Works Co., Ltd., specializing in electrical distribution equipment, died on 21st January at the age of sixty-four.

Mr. G. B. Carnegie.—The death has occurred at Gosforth, Newcastle-on-Tyne, of Mr. George B. Carnegie, managing director of G. B. Carnegie & Co., Ltd., electrical engineers. He was a member of the Electrical Contractors' Association.

Mr. George Gunn, M.B.E., A.M.I.E.E., generation engineer (operation) (East), South of Scotland Electricity Board, died in Edinburgh on 4th February at the age of sixty-five. Mr. Gunn served an electrical apprenticeship with Bruce Peebles & Co., Ltd., and a mechanical apprenticeship with Bertrams, Ltd. Following this he went to Africa and India as a ship's engineer, after which he obtained turbine manufacturing experience at the works of Messrs. Fairfield, of Glasgow. He then again went to sea and passed his chief engineer's examination. After service in the Navy in the 1914-18 war he entered the electricity supply industry, becoming charge engineer with the Edinburgh Corporation Electricity Department at Dewar Place power station. Two years later he went to Portobello power station while it was under construction. After some years as charge engineer he was appointed boiler house superintendent, later becoming assistant station superintendent, and in 1944 station superintendent. On nationalization he became generation engineer (operation), South East Scotland Division, C.E.A., and on the formation of the South of Scotland Electricity Board was appointed generation engineer (operation) (East) of the Board. Mr. Gunn was a past-president of the Electrical Power Engineers' Association. He received the M.B.E. in the recent New Year Honours.

Alderman J. W. Mayall.—The death is announced of Alderman J. W. Mayall, managing director of J. W. Mayall & Co., Ltd., Birmingham. He was seventy-two. After education at Stockport Technical School and Whitworth Street School, Manchester, Mr. Mayall held posts with the Manchester Ship Canal and E. Green & Co., Ltd., before starting his own business in 1915. He was president of the Electrical Wholesalers' Federation in 1935. He had been a member of the Sutton Coldfield Town Council since 1935 and was mayor in 1945-46. During the 1914-18 war he served in the R.F.C. and R.A.F.

WILLS

Mr. W. A. Scott, works manager to Lancashire Dynamo and Crypto, Ltd., 1930-40, who died on 25th October last, left £1,644 gross (£1,587 net).

Mr. H. Rottenburg, M.I.E.E., of Cambridge, who died on 25th March last, left £49,012 gross (£48,438 net).

Mr. J. B. Pearson, O.B.E., former chairman and managing director of Cowans, Sheldon & Co., Ltd., who died on 1st November, left £25,726 gross (£25,128 net).

Mr S. Booth, of Twickenham, Mdx., retired director of the British Vacuum Cleaner and Engineering Co., Ltd., who died on 30th October, left £30,490 gross (£30,428 net value).

Mr S. J. Pengilly, district engineer, West Cornwall District, South Western Electricity Board, who died on 1st July, intestate, left £6,538 gross (£4,598 net value).

330 kV TRANSFORMERS FOR AUSTRALIA

The first 330 kV transformers to be built in Great Britain are to be manufactured by the English Electric Co., Ltd., on a contract from the Electricity Commission of New South Wales. The order, worth about £250,000, is for seven 54,000 kVA 330 kV single-phase transformers, to be installed in the N.S.W. Commission's network for the Snowy Mountains hydro-electric system.

S.I.M.A. EXHIBITION

The Scientific Instrument Manufacturers' Association of Great Britain now have a permanent exhibition at their headquarters, 20, Queen Anne Street, London, S.W.1, of the products of their member firms. The display was opened on Thursday last week by Sir Norman Kipping, director-general of the Federation of British Industries.

The object of the display is to provide a centre where overseas visitors can see a representative selection of instruments made by over 140 member firms. An extensive catalogue library is being built up to aid inquirers. The centre will also serve as a common meeting ground for makers and users of instruments in this country.

Since it is impossible to give space to all members at the same time, a rota system has been worked out which will not only give every member a chance to exhibit, but will also ensure that the character of the display will change constantly. It is hoped that this will maintain interest in the exhibition and foster its use by visitors.

The type of exhibit on display varies from such fundamental items as the precision standard capacitors and inductances of H. W. Sullivan, Ltd., to complicated electronic apparatus for nuclear work by Ekco Electronics, Ltd. Twenty-four companies are exhibiting in the first selection.

ELECTRICITY SUPPLY WAGE INCREASE

About 120,000 workers in the electricity supply industry are to receive a wage increase of 4d an hour dating back to the beginning of the year. The pay of foremen is to be increased by £40 a year. The National Joint Industrial Council for the industry has also agreed upon an up-grading of certain classes of work, e.g. linesmen, at present classified as semi-skilled workers, are to be paid as craftsmen. The five unions to which the men belong had claimed an increase of 6d an hour.

EDMUNDSONS REUNION

The annual reunion of members of the staff of the former Edmundsons Electricity Corporation, Ltd., will take place on Friday, 13th April, at the Café Monico, London, W.1. The chair will be taken by Mr. H. C. Waters, deputy-chairman of the Eastern Electricity Board. This function has now become established, as the annual attendances prove. There are, however, many more who are eligible to attend and they are invited to communicate with Mr. F. T. Scribens, Room 425, C.E.A., Winsley Street, London, W.1, from whom tickets (price 24s each) may be obtained.

Financial Section

STOCKS and SHARES

FROM the Stock Exchange point of view, nearly two months looks a long period of suspense, but opinion round the House seems to think that markets cannot be expected, in the absence of developments unforeseen, to make much headway until the new Chancellor has revealed his intentions in April's Budget. Mr. Macmillan in his present role gave speculation little to work upon in his first important speech, except for anything that could be read into his electrical metaphor of the overloaded circuit from which he will have to pull out some of the plugs. For the present, markets seem likely to find interest mainly in the final dividend declarations and annual results, covering 1955, of individual companies. English Electric's announcements, due to appear in yesterday's (Thursday) papers, were expected to provide some guidance to prospects in this connection. Speaking generally, the tone of Stock Exchange markets as a whole is dull and unsettled, with business running sluggishly in nearly every department.

Plessey Issue

The Plessey Company is holding a meeting next Monday, 20th February, as a preliminary to the offer of 800,000 new 10s ordinary shares to existing shareholders. The latter are to be invited to subscribe, in the proportion of one new share at a price of 50s, for every two shares held. The need for fresh capital was referred to in the annual report issued last December. It is now explained that production in 1954-55 was £3 million greater than that envisaged at the time of the previous capital issue in 1954. The £900,000 raised then has been employed and further sums are now required for the financing of extensions to manufacturing facilities and of a larger volume of work. Just on £2 million will be produced by the coming operation.

Valuable Rights

With existing Plessey 10s shares quoted at around 72s at the time of the issue announcement, the "rights" to the offer of new shares at 50s had a value of a little over 7s per share. A substantial premium on the newcomers being in prospect, shareholders will note that they are invited to subscribe for the excess of shares not taken up by way of rights. Regarding dividend prospects after the increase in capital, the directors expect to recommend for the year ending next June a total of not less than 30 (against last year's 27½) per cent, divided equally between interim and final distributions, to both of which the new shares will be entitled. At an "ex-rights" price of say 65s for the shares, the prospective yield is thus over 4½ per cent—a considerably better return than has appeared for a long time on this active member of the electrical equipment market.

McKechnie Brothers

Electrical engineering is stated to be among the wide range of industries supplied by McKechnie Brothers, the manufacturers of non-ferrous metals and heavy chemicals, whose shares were due to be dealt in for the first time during the past week. Of the company's £1½ million in "A" (non-voting) shares, 300,000 have been offered publicly for sale at 55s per share. A small number of the £765,000 in ordinary shares has also been placed in the market. The prospectus gave the net assets of the business as £6·85 million, and a ten-year record of earnings showed substantial expansion over that period, with some irregularity between 1951 and 1953 due in large part to fluctuations in metal prices. Group profits of nearly £1½ million (before taxation) in 1954-55 compared with an average figure of a little under £1·2 million for the decade.

Dividend Prospects

For the year ended last July, McKechnie Brothers paid dividends equivalent to a total of 12½ per cent on the present ordinary capital. In the first part of the current year, earnings compared favourably with those of the previous corresponding period and, although profit margins are likely to be diminished by rising costs, it is the intention in the normal course of events to maintain the same total for 1955-56, with an interim payment in June. A distribution of 12½ per cent would be covered very comfortably three times over by the ten-year average of profits, and more than four times by the 1954-55 surplus. On the issue price of 55s, the "A" shares offer a yield of 4½ per cent.

Lindley Thompson Report

The 1s shares of Lindley Thompson Transformer (Holdings) were dealt in at a fraction over par after the appearance of the company's full report for the year to September last. Dividend for this period is being maintained at the rate of 12½ per cent paid for each of the other three years since the company was made public. Group profits, after tax, were close up to the previous result of £44,000, of which the distributions on the £100,000 preference and £230,000 ordinary capital together absorb £20,000. Revenue reserves are increased to £68,000, and no new capital is likely to be required for plans to improve the plant. Prospects are said to be obscured by the effects of the credit squeeze on business with the nationalised electricity supply industry and elsewhere, but the chairman says that increased efficiency should result in further improvement in turnover, and help towards the maintenance of the position.

Non-Voting Shares

A matter of practical importance to many private investors, and one which is currently coming in for attention, arises from the recent growth of large blocks of ordinary shares which carry no (or restricted) voting rights. These have materialised in the main from scrip issues, the result of which may be to enlarge the voting power of the ordinary at the expense of other classes of capital concerned. Hence there has arisen in some cases the practice of designating new issues as "A" shares, without votes, and of leaving the balance of voting power as it was. A consequence has been, in these instances, that upon the development of a market in the new issue an investor may buy shares without appreciating that he is acquiring no say in the conduct of the company's affairs. For a great many, this may be a matter of little or no consequence, but there is, nevertheless, a movement which thinks it desirable that more prominence should be given to it in the official description of the shares concerned. In the electrical markets, companies which have in issue both ordinary (or deferred) and "A" shares include Pye, Decca, B.E.T. and Hoover.

More Issues

Dealings began in the newly-issued Telegraph Construction and Maintenance 5¾ per cent unsecured loan stock 1974/76 at around the 100 mark. A million of this stock, which is at present £50 paid up, was placed privately at a price of 98. The proceeds are to be used for expenditure on the plant and buildings of the company itself, and of the associated company, Submarine Cables, Ltd.

In announcing details of the proposed one-for-four scrip issue, the Nigerian Electric Supply Corporation advises shareholders that the new shares will be entitled to any dividend in respect of 1955-56, and that in view of satisfactory results to date in the current year (which ends this month) there should be no difficulty in maintaining the existing rate of distribution on the increased capital. The £1 shares were raised 1s, to 24s 6d, after this announcement. Assuming a total dividend of 10 per cent, and adjusting the price of the shares to the scrip issue, the prospective yield goes up to over 10 per cent. The necessary meeting is being held next Wednesday, 22nd February.

We apologise to readers for the continued absence of our share lists necessitated by the dispute in the printing trade.

REPORTS and DIVIDENDS

The Plessey Co., Ltd., is to make a rights issue to ordinary shareholders of 800,000 10s ordinary shares at 50s per share in the proportion of one new share for every two held. The new shares will rank for dividend and in all other respects *pari passu* with the existing ordinary shares. The net proceeds of the issue are estimated at £1,961,000. In a circular to shareholders the company states that when last an issue of shares was made, in 1954, shareholders were informed that production was expected to expand over the following year or so, and that accordingly further financial resources were required. Expansion in production has been in excess of the amount estimated by a substantial margin and production for the year ended 30th June last was more than £3,000,000 greater than was anticipated when the plans were formulated on which that issue of shares was based. This expansion continues and further capital is required for the extension of manufacturing facilities and to finance the greater volume of work which will result.

Hilger & Watts, Ltd., report a group profit, before taxation, for the year to 30th September last of £124,193, as compared with £99,799 for the preceding year. Taxation absorbs £69,144, leaving a net profit of £55,049 (against £41,493), to which is added £9,818, taxation provisions no longer required. A sum of £7,501 is retained in subsidiary companies and the balance of £57,366 goes to the parent company. It is proposed to pay a dividend for the year of 10 per cent (compared with 9 per cent). The balance carried forward is £127,925 (against £91,844 brought in).

J. & E. Hall, Ltd.—The net profit for the year to 30th September last, after providing £255,000 for taxation, is £234,836, as compared with £219,342 for 1953-54. It is proposed to pay a final dividend of 10 per cent, making 12½ per cent for the year. For the previous year the interim dividend of 2½ per cent was followed by a one-for-two scrip issue and a final dividend of 10 per cent on the increased capital. The balance carried forward is £705,526 (against £576,771 brought in).

The Nigerian Electric Supply Corporation, Ltd., is to make an issue of one new £1 ordinary share for every four held. This will capitalize £148,636 of general reserve, leaving a balance in reserve of £100,000. The directors state that the cost of the Jekko 2 power station, which came into operation at the beginning of the last financial year, was met primarily by the permanent investment of earnings which in other circumstances would have been available to some extent for distribution to shareholders. The depreciation reserve is in excess of requirements and they have therefore transferred £118,636 to general reserve. The new shares will rank for any dividend in respect of the year to 29th February next, and with the current year's results to date satisfactory, there should be no difficulty in maintaining the existing rate of distribution on the increased ordinary capital.

Broadcast Relay Service, Ltd., is making a rights issue of 1,928,116 ordinary 5s shares at 14s a share in the ratio of two shares for every 15 ordinary 5s stock units held. The new shares will not rank for the final dividend for the year ending 31st March next, but for all subsequent dividends. The net proceeds will finance expansion of the group both at home and abroad, including commercial television.

The Electrical & Industrial Investment Co., Ltd., reports a net profit for 1955 of £71,636, as compared with £59,363 for 1954. The dividend for the year on the deferred ordinary capital is maintained at 80 per cent.

New Companies

Electrovac (Scientific), Ltd.—Registered 6th December. Capital £1,000. Manufacturers of and dealers in electronic tubes and valves of all kinds, etc. Secretary: Helen E. Mitchell. Regd. office: 22, Lawn Lane, Hemel Hempstead, Herts.

H. Harding (Electrical), Ltd.—Registered 27th January. Capital £5,000. Electrical engineers and contractors, etc. Directors: H. Harding and K. G. Harding. Regd. office: 57, Clarence Road, Bristol, 1.

Reliance Electric (Great Barr), Ltd.—Registered 31st January. Capital £500. To install, develop and operate radio and television relay equipment, etc. Directors: H. W. Blunn and Emma W. Blunn (secretary). Regd. office: 312, Oxhill Rd, Handsworth, Birmingham.

Poole Electrics, Ltd.—Registered 31st January. Capital £100. Electrical engineers, etc. Directors: E. R. G. Ovenell, R. J. Newton and G. E. Newton. Secretary: C. D. Barlow. Regd. office: 6, Alder Road, Branksome, Poole, Dorset.

Vibrette (Holdings), Ltd.—Registered 1st February. Capital £100. Electricians, mechanical engineers, manufacturers of and dealers in electrical apparatus, etc. Directors: W. J. Graham-Palmer and Mrs. Eily Graham-Palmer. Solicitors: Philip Conway Thomas & Co., 19/20, Bolton Street, London, W.1.

Liquidations

Autoventions, Ltd., manufacturers of electrical goods.—Last day for receiving proofs for dividend to preferential creditors 18th February. Liquidator, Mr. J.M. Clarke, Senior Official Receiver and Liquidator, Inveresk House, 346, Strand, London, W.C.2.

Alexander Electrical Co., Ltd., Winding up voluntarily. Liquidator, Mr. F. S. Young, 5, Mansfield Street, London, W.1, appointed 3rd February.

Edolite Lamps, Ltd.—Liquidator, Mr. A.T. Eaves, 47, Mosley Street, Manchester, 2, released 9th January.

Bankruptcies

H. Harding, carrying on business at 15c, Mill Lane, Macclesfield, Ches., electrical contractor.—Receiving order made 1st February on debtor's own petition.

R. A. Norman, residing at 5, Bright Street, Middlesbrough, and formerly at 31, City Road, Middlesbrough, and carrying on business at 25, Cleveland Street, Middlesbrough, as an electrical retailer and contractor.—Receiving order made 1st February on debtor's own petition.

W. V. Tupling, electrician, carrying on business at 27, Church Street, Warsop, Notts.—Trustee, Mr. R. F. Bendall, 126, Colmore Row, Birmingham, 3, appointed 1st February.

F. Robinson, 78, Scholes, and 112, Frog Lane, Wigan, electrical contractor.—First and final dividend of 9s 4d in the £, payable on and after 21st February at the Official Receiver's office, West Africa House, 25, Water Street, Liverpool, 2.

D. E. Pitchers, 89, Gorleston Road, Oulton Broad, Lowestoft, electrician, formerly trading at 13, Tann Lane, Caister-on-Sea, radio and electrical engineer.—Receiving order made 24th January on debtor's own petition. Public examination 23rd February at the Town Hall, Great Yarmouth.

EQUIPMENT FOR GLASGOW TROLLEY-BUSES

A further fifty sets of trolley-bus equipment have been ordered by Glasgow Corporation from the Metropolitan-Vickers Electrical Co., Ltd. The company had previously supplied thirty-one sets of trolley-bus equipment to Glasgow. The new equipment, which will be made at the M-V Works at Sheffield and Trafford Park, will be installed in double-deck two-axle buses being supplied by British United Traction, Ltd., and these are expected to be in service during 1957.

The electrical layout and design follow closely those of the sixty-two sets recently supplied to Manchester Corporation. Each equipment embodies a master controller-reverser unit which is cam-operated and incorporates in one assembly the accelerating and braking controllers, the reverser, and the parallel-series battery switch for controlling the 30 V 52Ah Nife battery for battery manœuvring. The battery is charged by a "Metrovick" overhang generator with an output of 1,800 W at 30 V.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Lighting Engineers' Salaries

AS a Registered Lighting Engineer (I.E.S.), who had over 15 years experience of appreciation from a lighting fittings manufacturer, I enjoyed reading the very amusing letter from Mr. A. E. Iliffe—over 3½ inches of single column without saying anything definite. The rose-tinted vistas of promotion and higher salaries in the field of illuminating engineering conjure up visions of budding lighting engineers so dazzled by the glittering prospects before them that they suffer from " glare disability " and fail to recognize the vista for what it really is - a mirage that they will chase for the rest of their careers. The carrot on the end of the stick.

However, Mr. Iliffe was right in suggesting the Register of Lighting Engineers as a qualification and a study of this register will show that of the lighting engineers employed by lighting fittings makers nearly all are engaged in the sales organization of their companies and the remuneration they receive is dependent more on their success as salesmen than on their abilities as lighting engineers. Even regarding them as salesmen and not engineers, most fittings makers' salary policy seems to be to pay no more than " replacement value, plus ".

It would be both misleading and wrong to quote actual salary figures but, to help your readers to form their own opinions, it can be taken that most of the lighting engineers employed by fittings manufacturers receive about the same remuneration as the salesmen of the leading lamp manufacturers and a bit less than an established representative of a reputable wholesaler.

Manchester. H. ATHERTON.

Golf Challenge

I AM writing to inquire if you would care to publish a challenge from my company to meet any company or group of companies in the electrical industry in a golf match, the losers to send the sum of twenty-five guineas to the Electrical Industries Benevolent Association.

Whilst a comparatively small company, we think we can field a team which would hold its own with any of the giants in the industry and we shall be prepared to play any interested party on any course that they care to select; we would naturally expect to be the hosts.

You may consider this to be an unusual request, but we feel sure you will accommodate it in the interests of good fellowship.

E. B. M. GRUBB,
General Sales Manager,
Davis & Timmins, Ltd.

Walthamstow, E.17.

PULSE TECHNIQUES

IN a lecture on 8th February to members of the Institution of Electrical Engineers on pulse techniques with particular reference to line and radio communication, Dr. E. M. Deloraine said that, looking back on the past twenty years, it seemed that it might have been wiser to recognise from the start that signals originating or terminating at a telephone subscriber set or telegraph apparatus should have characteristics comparable to telephone currents. Alternatively, a unique method of translation at the central office would have enabled offices of different types in any network to originate and receive the same voice-frequency signals. The problem of interconnection of offices or networks would then have been limited to the satisfactory transmission of telephone currents. Even now a return to what could have been the original concept might be necessary. Devices were now available which facilitated the solution to the problem, e.g. semi-conductors, transistors and electronic switching.

Efforts continued to be directed towards the complete elimination of infra-acoustic pulse transmission in telephone circuits, which affected the design of future subscriber sets and telegraph apparatus. The telephone set problem was great simplified by the introduction of transistors or similar devices. With their very modest power consumption one could envisage generation at the subscriber set of voice-frequency signals for controlling the selection, and generation, on receipt of a calling signal at voice frequency, of a suitable audio signal replacing the present ringer.

Pulse modulation called for the elimination from the line of all amplitude modulated signals including speech, and their replacement by pulses carrying the intelligence. It represented a come-back of the telegraph art, but with much shorter pulses entailing improvement of analysis and measurement of transient phenomena.

After the war many radio links using pulse multiplex appeared with a view to arriving at a multiplex system which might be less critical and simpler than its frequency-division multiplex counterpart. A number of combinations were used, most of them with pulse-time modulation of the voice channels and amplitude modulation of the carrier. The designers found that those pulse systems, compared with frequency-division systems, were not critical in link requirements. The systems would accept greater length of antenna feeders, more phase distortion, more amplitude distortion and poorer impedance adaptation of line to antenna than frequency division systems using minimum bandwidth for equal results. Fading might be minimised, particularly over water, by the use of diversity reception, simply by paralleling the automatic gain control and the output of the two receivers. In frequency-division it appeared necessary to measure the two levels and to commute at high speed from one receiver to the other.

Pulse code modulation systems had not yet been used, to his knowledge, on commercial radio links, probably because their advantages increased with distance and most pulse links had not been engineered for very long distances.

Production difficulties caused by the dispute in the printing industry still continue and we again ask our readers' indulgence for certain deficiencies which may be noticed in this week's *Electrical Review*.

INDUSTRY AND THE HOUSE

Thoughts on the Herbert Committee's Proposals

By A. M. F. PALMER, A.M.I.E.E., M.P

AFTER the very different Guillebaud Report on the working of the National Health Service, the Herbert Committee's study of the electricity supply industry has had a marked impact on the House of Commons. Many honourable Members were to be seen, on the day the report appeared dressed in its conventional Blue Book cover, with it in their hands or thrusting out from their pockets. As parliamentary reading its attractions will soon pall, but in the meantime it has caused more than a small ripple in the pool of lobby life, so often agitated by the splash of far more trivial events.

It is useful now to take our minds back to July, 1954, when Mr. Geoffrey Lloyd first appointed Sir Edwin Herbert and his colleagues "to review the organisation and efficiency" of electricity supply seven years after nationalisation. The idea of the inquiry was brought forward, as it had to be, by the Government, but it received also the polite approval of the Opposition. It was understood, of course, that the principle of national ownership was not in question. Many people probably felt then that since electricity was acknowledged to be nationalisation's brightest jewel, nothing very controversial or condemnatory was likely to emerge as a result of the exercise. Complacency on that score, however, has been dispelled by the publication of the report. Sir Edwin Herbert's Committee—which included Mr. Jack Tanner of the T.U.C. and the Amalgamated Engineering Union—have succeeded, if all they say is to be believed, in discovering behind the façade of the C.E.A. serious cracks and weaknesses in the outwardly glittering structure.

They state, for instance, that in management methods the industry lags behind the best available practice; there is lethargy about bringing down costs; staff redundancy goes unchecked; operational research and work study are not applied, even when understood. The report complains that the Electricity Boards are not doing anything like enough to arrest the drift away from the industry of capable leaders and are not succeeding, judged by results, in attracting a sufficient flow of qualified recruits.

All these criticisms and many more besides must be galling to Lord Citrine and his colleagues, who have laboured hard and long since 1948 to bring about an organisation of the industry which seems good to them. Yet it is difficult to avoid the conclusion, after turning over these many pages (written incidentally with a salty vigour of language), that the Herbert olympians would prefer those who sit at the top of affairs to be less nervously obsessed with detail. "Relax, and again relax" is their advice. Far too many of the innumerable decisions of the industry, they hint, are made at the centre by a small group in defiance of every known sound principle of management.

Lord Citrine has given it out that he and the C.E.A. are now considering the report in detail and intend to meet the Committee for an "informal discussion". This piece of news may well suggest at least one possible approach by the Government. Since there is great pressure on parliamentary time (a likely to be bitterly contested Monopolies Bill is coming along), may it be that the new Minister, Mr. Aubrey Jones, will refer the report to the industry with a request to examine how far the main proposals and recommendations can be implemented, short of a parliamentary Bill? There are some signs, in any case, that the Government would prefer an agreed measure, as between the two sides of the House, if legislation became inevitable; the recent experience over road transport may be in their minds.

On the other hand, Mr. Aubrey Jones has a reputation for being a man of originality and, if other courses fail, he will not hesitate, I think, to fling both his own authority and the weight of the Government's parliamentary majority behind the report. On the balance of political advantage this course would be tempting for it would rally embittered Conservative fuel and power critics in support of the flag. I refer to the trend towards a private enterprise conception rather than a public service outlook for the industry, noticeable in so many places within the Committee's findings. The Committee frown for instance upon the use of the industry as an instrument for re-distributing the national income and even go so far as to condemn rural electrification when it does not pay off commercially. These views will be unpalatable to Labour Members, although they are not likely to be too much offended by the additional criticism that the Electricity Boards have tended to buy British from manufacturers at home when they should have exerted pressure to bring down prices by threatening to go overseas for supplies.

Stabilization of Prices

At question time on Monday last week Mr. Aubrey Jones made his debut at the dispatch box, looking after himself very well against a barrage of questions from familiar mouths behind demanding that he direct the fuel and power industries to stabilize prices. One adventurous Conservative back bencher, who had presumably not heard of collective bargaining, thought that the Minister should fix the wage and salary levels as well. These questions were probably intended as diversionary fire to draw off the attack on the Government by Mr. Gaitskell and his supporters for their failure to hold prices and combat inflation generally. The timing of the attack was bad, however, for whatever criticisms may be justly made of the coal and gas industries, electricity supply stands well in the matter of low prices. Indeed, the industry might well feel that the unkindest cut of all from the Herbert Committee was the implied criticism that too much has been done for the consumer: that electricity is too cheap and should be dearer.

On the same day, when the price stabilization storm over nationalised industry had died down, the writer was able to ask the Minister if he would make available to Parliament the evidence submitted to the Herbert Committee. Mr. Jones politely declined to do so on the ground that this was within the discretion of the Committee and they had decided not to publish; he still refused to budge when tweaked further by the suggestion that some of the evidence had been published privately anyhow. Mr. Gerald Nabarro generously offered to make his own personal evidence to the Committee available, but there seemed to be no takers anywhere in the House.

PARLIAMENTARY REPORT

IN the House of Lords, Lord Hawke, Lord in Waiting, indicated that the proposal to provide a speedy means of travel between London and London Airport by introducing a monorail service or by extending the existing London underground system had been ruled out in favour of a possible rail link. This would run from the airport to connect with the Southern Region railway at Whitton Junction, and would run via Barnes and Clapham to Victoria station. It would involve constructing a tunnel under the airfield and the possible doubling of a fair section of track and would cost about £10 million, he said. It seemed the best link available but if it were decided upon the Government would still have to consider the financial and steel supply situation before approving it.

Imperial College of Science

Replying to Viscount Falmouth, the Earl of Home, Secretary of State for Commonwealth Relations, said that in view of the urgent need to increase the number of scientists and technologists, the Government had decided, notwithstanding the difficulties, to carry out the full scale of development for the Imperial College. New premises would be found elsewhere for the Imperial Institute.

University Grants

In the House of Commons Mr. Eric Fletcher asked the Chancellor of the Exchequer if, in approving university grants for the next quinquennium, he would ensure that specific funds were allocated for scientific research at university institutions to meet the urgent and growing national needs of technological education.

Mr. Brooke said the Chancellor would take full account of the needs of technological education in determining the amount of grant to be made available to the universities through the University Grants Committee. Recurrent grants were in aid of their general income, and it was not proposed to earmark part of them for specific purposes.

Mr. Fletcher said that Parliament would not get adequate sums spent on technical education unless the University Grants Committee had power to earmark moneys specially for that purpose.

Mr. Brooke said it was with the full agreement of the universities that the practice of earmarking recurrent grants was abandoned. Discretion was now left to them.

Fuel Research

Mr. Frederick Willey asked what progress had been made with the provision of a new Department of Scientific and Industrial Research fuel research station.

Mr. Bevins said a site for a new fuel research station had been selected at Stevenage. The preparation of plans and estimates was progressing and it was hoped that work would begin on the site in 1957.

Technical Education

Sir David Eccles, Minister of Education, said that the Government's plans for technical education in the next five years would be described in a White Paper which the Government would publish before the end of this month.

Profits Tax and Exports

Mr. A. J. Irvine asked why the Government had not provided for a lower rate of profits tax to be imposed upon trading company profits derived from export trade. Sir E. Boyle replied that the Government was not satisfied that such a step would be in the national interest.

Compensation Regulations

Mr. Palmer asked the Secretary of State for Scotland when the regulations required under section 12 of the Electricity Reorganisation (Scotland) Act, 1954, dealing with compensation to officials would be laid before Parliament.

Mr. J. Stuart said that he regretted that it had not yet been possible to complete the preparation of these regulations, but every effort would be made to do so at an early date.

Questions on Nationalized Industries

Capt. Pilkington asked whether the Prime Minister would take steps to alter the present practice so as to enable Members to ask questions about the nationalized industries in the same way as they could about non-nationalized industries.

Mr. R. A. Butler, Lord Privy Seal, said that the Prime Minister was aware of the desire of Members to have full information about the nationalized industries. How this might best be achieved was now under fresh consideration by the Government, following the recent report of the Select Committee on Nationalized Industries.

Tax on Heat Pumps

When Mr. Albu asked whether the Government would remove the purchase tax on domestic heat pumps, Mr. Henry Brooke, Financial Secretary, Treasury, said that these appliances served the same purpose as electric heaters and refrigerators and, in fairness, must bear the same tax.

Mr. Albu asked if the Minister was aware that these appliances, used in place of a domestic boiler, saved 1-1½ tons of coal in a house in a year, and that one of the two firms which manufactured domestic heat pumps had ceased to make them because of the high level of tax.

Mr. Brooke said it would be unfair to the makers of ordinary heaters and refrigerators if the appliances were singled out for tax exemption.

Mr. Usborne pointed out that the Treasury was deliberately excluding oil burners, which produced heat like these other appliances, from taxation. Could he explain what difference in use there was between an oil burner and a heat pump?

Mr. Brooke: "That is rather a different question."

Rating and Income Tax

Mr. Brooke said the new rating valuations could have no effect on the existing Schedule A assessments on property without specific legislation. The Royal Commission on taxation had made certain recommendations but the Chancellor had not yet completed his consideration of the matter.

Trade Fairs in Asia

Mr. Peter Smithers asked the President of the Board of Trade whether he was satisfied that British industry was adequately represented at the Indian Industries Fair and at the Pakistan International Fair and whether he would review the existing policy with regard to such matters in the light of special conditions existing in Asia.

Mr. Low, Minister of State, said the Government was considering whether any special action should be taken for future Fairs in this area in view of these special conditions.

Uskmouth Accident

The Minister of Fuel and Power, Mr. Aubrey Jones, replying to Mr. P. Freeman, said that preliminary reports on the accident at Uskmouth generating station on 18th January showed that part of the rotor in one of the generating sets broke through its casing, but why this happened was still being investigated.

Additional Television Channels

Dr. Hill, the Postmaster General, when asked by Mr. Allaun when the B.B.C. would be allowed to erect transmitters for its second television service, said the Corporation had applied for authority to proceed with a second television programme and the matter was still under consideration. He also told Mr. Ness Edwards that two channels in Band III were at present in use for television and a third would become available about

the middle of this year. Plans had been prepared to free two further channels and the Post Office was pursuing the problem of releasing the remaining three.

Hire-Purchase Trading

Mr. Gresham Cooke asked the Minister of Fuel and Power if he would issue a general direction to the Central Electricity Authority forbidding it to offer hire-purchase facilities subsidized by its other operations.

Mr. Aubrey Jones said he was in general satisfied that, thanks to the fair trading principles established between the Electricity Boards and private contractors, the Boards did not indulge in unfair competition by charging costs incurred in retail activities to electricity supply. The Herbert Committee had, however, made what seemed to him a sensible suggestion that, in future, separate accounts should be published for retail and other activities and he was considering this.

Mr. Fletcher-Cooke asked the Minister if he would agree that the hire-purchase business of the Central Electricity Authority had doubled in the last year and that the facilities offered were below cost? Was that fair competition?

Mr. Jones: "It is my aim, so far as is practicable, to eliminate unfair sources of competition, but not to eliminate competition entirely."

Mr. Kenneth Robinson asked the Minister by what authority Electricity Boards threatened to discontinue the supply of electricity because of failure of the consumer to keep up to date with hire-purchase payments on electrical equipment.

Mr. Jones said that the Boards had no such general authority but there were still in existence a number of local enactments which permitted some Boards in certain districts to disconnect for such reasons. "I would like to take this opportunity of saying that I would deprecate the use of these powers," he added.

Wage and Price Stabilization

Mr. Nigel Fisher and other members asked the Minister if he would give a general direction to the nationalized fuel and power industries to stabilize both the wages to their employees and prices to the public for a definite period, in an effort to correct the present inflationary wage-price spiral.

Mr. Jones replied that while he accepted the desirability of a restraint in prices, he considered that it would be quite wrong to enforce a general rule on the industries for which he was responsible. Regard must be paid in each case to individual circumstances, and in particular to the present state of finances in relation to the statutory requirement to make ends meet. Answering Sir James Hutchison, he said that it was open to any Area Electricity or Gas Board to do what the South of Scotland Electricity Board had done. The questions had asked him for compulsion, which was quite a different matter. He added, in reply to Mr. Shinwell, that his power to give directions to the nationalized Boards was open to great legal doubt.

Mr. Jones said he did not disagree with the policy of price stabilization but the ability of an industry or a firm to follow it depended largely on the state of its reserves. In general, the reserves of the nationalized undertakings were more exiguous than those of private undertakings. In reply to Mr. Nabarro, the Minister said he did not agree that the reserves of the Electricity Boards were fully adequate for all their development purposes.

Herbert Committee's Report

Mr. Palmer asked the Minister if he would make available to Parliament a record of the evidence given to the Committee, under the chairmanship of Sir Edwin Herbert, which has recently reported on the electricity supply industry.

Mr. Jones: "No, Sir."

Mr. Palmer said that some of the evidence had been published by the associations and organizations who submitted it. In view of some of the more controversial passages in this generally interesting report, would it not be of value to the House to have the whole of the evidence so that they could judge the whole thing quite fairly?

Mr. Jones said that it was for the individual organizations to decide whether they wanted to publish their evidence. The Committee had decided not to publish the whole evidence and he saw no reason why he should intervene or differ from its decision.

Mr. Callaghan asked why the Committee reached that decision.

Mr. Jones said that some of the evidence of a confidential nature would not have been procured if there had been an intention to publish the evidence. To publish the non-confidential evidence would give a misleading impression; to publish the confidential evidence would be a breach of faith.

Tenders for Contracts

Mr. Eric Johnson asked the Minister of Fuel and Power if he would give a general direction to the National Coal Board, the Central Electricity Authority and the Gas Council to advertise publicly for tenders for all work they were letting out to contractors.

Mr. Jones replied that the precise arrangements adopted by the nationalized industries in placing their widely differing types of contract were matters for the industries themselves to decide.

Mr. Johnson said that before nationalization it was the practice of most electricity undertakings to advertise publicly for tenders, where as now the practice was that only a few people were invited to tender. Was not this more likely to lead to an agreement to quote the same price?

Mr. Jones said that it was a matter of day-to-day administration and it would be wrong for him to intervene unless there was very grave cause.

Reduced Voltage

Colonel Stoddart-Scott asked the Minister if he was aware that the Yorkshire Electricity Board was supplying Pool-in-Wharfedale and Arthington with electricity which fell below the statutory voltage limit and what action he proposed to take.

Mr. Jones replied that this happened during periods of peak demand and 874 consumers were affected. The Board had planned a major reinforcement scheme for completion by next winter to improve the position.

Calder Hall

Mr. Nabarro asked the Lord Privy Seal whether he would now state the date on which it was expected that Calder Hall would begin operating.

Mr. R. A. Butler replied that the Queen would switch into the national grid the electricity generated by the first of the two reactors at Calder Hall power station on 17th October next. The second reactor should be in operation within six months of the opening ceremony.

Copper Supplies

In answer to Mr. Frederick Lee, Mr. Derek Walker-Smith, Parliamentary Secretary, Board of Trade, said that he had no reason to suppose that industry was unable to obtain sufficient copper. Stocks with the trade were about 78,000 tons at the end of November, amounting to two months' requirements.

New Mullard Factory

Mr. Burke asked the President of the Board of Trade when it was expected that the Mullard factory in the North-East Lancashire Development Area would be in full production.

Mr. Peter Thorneycroft said it was expected that this factory would be in full production by the end of the year and would then employ upwards of 1,000 people, mainly men.

Trade with China

Replying to Mr. Swingler, Mr. Nutting, Minister of State, said that only one Western member State of the United Nations had issued licences for the export of turbo-generators to China and these exports had not yet taken place. The Government did not consider that this was a sufficient reason for revising their own controls.

Blyth Power Station

The Blyth Generating Station (Ancillary Powers) Bill passed its third reading in the Commons and now awaits the Royal Assent.

Electronics and Productivity

GLASGOW CONFERENCE AND EXHIBITION

IN Glasgow from 6th to 9th February a Conference and Exhibition on "Electronics and Productivity" was held under the auspices of the South of Scotland Electricity Board. The following are summaries of the nine papers which were presented.

Mr. R. McGlashen, A.M.I.E.E., G.I.Mech.E. (South of Scotland Electricity Board) explained that the inertia-less nature of electron particles allowed them to respond instantaneously to any force imposed on them, and the electricity outside a valve was compelled to follow the electron movements. A valve was able to move electrons across in pulses with very small time intervals between; for industrial purposes as many as 100 million pulses per second might be used. The high frequency electricity appearing outside the valve as a consequence of these pulses was able to reach into the inner substance of materials such as wood and plastics and heat them by vibrating their molecules. The valve as a high speed once-per-cycle switch was considered together with its applications in the field of motor speed control, welding and illumination. Electronically controlled machine tools were described, and an example was given of a three-dimensional cam produced from the drawing, without templates, in four hours compared with three weeks by present methods, while machining time of another component was reduced from two weeks to 10 minutes.

Control of Aqueous Solutions

Speaking on "Aqueous Solutions in Industry - Control of their Compositions to Save Materials," Mr. R. S. Evans, M.A. (Cantab.) (W. G. Pye & Co., Ltd.) said that perhaps one of the most important steps forward was the introduction of the direct reading pH meter as an alternative to the older, potentiometric type. This latter instrument, although eminently satisfactory for research work in the hands of skilled chemists, could never really be applied to the much wider field of plant control, in the hands of semi-skilled operators. Direct reading pH meters, besides being extremely simple to operate, also had the very valuable feature of giving an output current proportional to pH reading. This could be used to operate ancillary equipment for recording, alarm-operating and control applications. Instruments available included extremely stable mains-operated types for research and routine laboratory use. These were fitted with circuits which compensated manually or automatically for the changes in glass electrode sensitivity which occurred with temperature change. The electrode assemblies, fully protected to guard against accidental damage, were usable over the entire range of 0-14 pH and at elevated temperatures.

Mr. S. B. Knowlden, B.Sc.(Lond.), A.R.C.S., A.R.I.C. (Isotope Developments, Ltd.) read a paper on "Applications of Nuclear Isotope Devices to Simplify Production Problems". He said the applications were broadly based on the following: research, the use of radioactive isotopes and radiochemicals; industry, the use of isotopes and electronic instruments for the purpose of improving and speeding productivity; and reactors, a special branch of reactor instrumentation and engineering for the production of power for industrial and experimental reactors. In the case of laboratory uses, methods depended upon the fact that radioactive isotopes were virtually identical with ordinary chemicals, but gave off specific radiation, which might be measured in very small quantities, thus adding a new tool to the more conventional means of carrying out analyses. Industrial applications depended upon the differential absorption of a radioactive beam, the ionizing effect of isotopes and their destructive power in laboratory multi-curie sources.

In a paper on "Electronics and High Productivity in the Heating and Joining of Metals," Mr. F. L. Gladwin (Wild-Barfield Electric Furnaces, Ltd.) stressed that the paper was intended to point out some of the practical uses of the high frequency induction heating process and to emphasize that it was now widely used in the engineering industry and was not confined to mass production factories. The principle of the induction heating process was described and it was pointed out that it could be considered as a basic substitute for other conventional types of heating, but preferably as a selective means of applying heat to parts which lent themselves to the process. One of the primary advantages was that the operation could be very closely controlled and repeated. Once set up, the operation was extremely simple and could be carried out by unskilled female labour, or in many cases it could be made completely automatic. The process was clean and heat was generated only in the product and that, together with the fact that batch treatment was not necessary due to the rapid heating, made it possible for the induction heating plant to be placed in the production line, thus eliminating the costly handling of components in batches to and from a heat treatment shop. Parts had a high degree of uniformity owing to the fact that repetition was not dependent on the human element. Parts treated by the induction heating process were characterized by the virtual elimination of distortion and absence of scaling, thus eliminating some, if not all, of the cleaning and finishing operations. Fuel costs were generally lower than by conventional methods of heating, especially in cases where only localized heating was required, as whilst the electrical efficiency of the generator was low, the thermal efficiency of the process was high as heat losses by radiation were confined to the work only.

Joining Wood and Plastics

Dealing with the heating and joining of wood and plastics, Mr. M. O'C. Horgan, O.B.E., M.Sc., M.I.E.E. (General Electric Co., Ltd.) showed how the amount of heat produced by a commercial h.f. generator depended on the frequency, the applied voltage and certain electrical properties of the materials. The capital cost of the generators was high and this, more than any other single factor, determined whether an application technically quite suitable was likely to be economically attractive.

Applications which had proved economically attractive in practice were quoted. For instance a car dashboard made from 8-ply laminated board ½in thick with curvature in two different directions could be glued in five minutes with low power consumption. Final examples were given from the rubber industry where dielectric heating was used to preheat blocks of rubber before moulding in a press, thereby producing a 60 per cent increase in the press output.

Mr. R. J. F. Howard (Lancashire Dynamo Electronic Products, Ltd.) covered the subject of "Electronics and the Control of Machinery to Boost Production". He explained that electronic control equipment for industrial

machines often involved various methods of controlling the speed of electric motors, incorporating, in most cases, a "closed-loop" or "error actuated" servo system. In addition to straightforward speed control, other speed dependent variables were regulated, e.g. pressure, flow, temperature and tension. Electronic drives having very high accuracy of speed regulation found many specialized applications in industry and research where high performance was vital.

In process work, the control of the multiplicity of operations on sugar centrifugals was an interesting example of a combination of electronic process timing with specialised electronic speed control, the latter providing numerous controlled acceleration and deceleration rates throughout the cycle. Position control was used in the case of machine tools for copying applications.

The applications of more simple types of control using, for example, photoelectric and similar techniques were also important such as that of automatically dimensioning and cutting rubber sheet in tyre manufacture. Already numerous equipments had given many years of service in almost every industry.

In lecturing on "Electronics and the Control of Industrial Processes to Boost Production," Mr. J. E. Fielden, M.Sc., A.M.I.E.E. (Fielden Electronics, Ltd.) treated the subject from the point of view of the business executive or plant manager. Electronic instruments fell into two categories: those enabling something to be done which had been impossible by other means and those that did a job, at present being done by other means, more efficiently or cheaply.

The remarkable ability of electronic apparatus to operate powerful self-balancing servo-mechanisms was the main feature of "automation" which was now being so widely publicized. He illustrated on a blackboard the simplicity of the principles involved and showed that it was quite unnecessary for there to be any intimate knowledge of the working of typical apparatus to obtain benefit therefrom, any more than the average person obtained less recreation from a television set because of his ignorance of its workings. In conclusion he suggested that business executives and plant engineers should examine the products in the exhibition to see whether in fact, by ignoring them, they were not applying brakes to their own progress.

Mr. G. S. Kermack, B.Sc., D.I.C. (Ferranti, Ltd.), in his paper on "The Batch Manufacture of Precision Components by Computer-Controlled Machine Tools," said that in the past great attention had been paid to methods of speeding and cheapening the production of large quantities of identical items. Less work had been devoted to the problem of the manufacturer who only had small runs of any given item, and the same problems were met in most development work where prototype models were usually required in a hurry.

The aim of the Ferranti system for the computer control of machine tools was to make the best use of available skill and to provide a method of controlling individual machines so that the resulting part was available much more rapidly, and at an economic price. The digital computer included was capable of carrying out routine, but nevertheless quite involved, calculations at a very high speed. From a productivity point of view it could be shown that the amount of work which could be obtained from a single machine controlled in this way was at least five times the output from a similar machine operated by hand. Also one computer would be quite capable of preparing the work for at least fifty separate tools all engaged on different work.

A paper on "The Electronic Computer as an Aid to Design and Production Planning" by Mr. O. B. Chedzoy, B.Sc. (English Electric Co.) contained an introduction to computing equipment in general mentioning that analogue and digital computers were complementary in use in design offices. It was in the aircraft industry that the computer contribution was most marked, and the calculations on flutter represented only a few of the problems where these computers had been of invaluable assistance. Atomic energy, too, provided great scope for automatic computing, and the design of a proton synchrotron for the European Council for Nuclear Research was referred to. Amongst the most important uses from the manufacturers' point of view were problems in heavy electrical engineering.

Production planning was referred to briefly and several possible applications were discussed. Stores control, efficient use of products, planning of future production lines, as well as the positioning of manufacturing plant and warehouses formed a selection of such applications of the "academic" computer.

Overload Capacity

A DISCUSSION on the co-ordination of overload capacity was opened on 25th January before the Supply Section of the Institution of Electrical Engineers by Mr. H. G. Bell. By utilizing overload capacity as was done in the U.S.A., he said, capital expenditure could often be postponed. This practice was, however, associated with increased losses and voltage drop, which sometimes made underloading of equipment more economical.

A limited or different overload capacity of one component of a transmission unit, comprising switchgear, transformers, cables and overhead lines, might restrict the use of overload capacity of the others. Standard ratings of busbars and of switchgear were in amperes, of cables in sq in of cross-section and of transformers in kVA or MVA.

Some guidance on permissible overloading of transformers was given in B.S. 171: 1936 but the "Loading Guide for Transformers up to 10 MVA with ON Cooling" (C.E.A., 1953) was more easy to apply and enabled the permissible loading with various ambient temperatures and the reduction of working life that would result from overloading to be calculated. The B.S. gave a warning that oil might deteriorate more quickly than other items.

Tables prepared by E.R.A. and the Cable Makers' Association showed safe working temperatures and continuous and intermittent loads for paper- and cambric-insulated cables, but overload capacity depended upon so many variables as to preclude generalization. Thermal ratings of overhead lines for distribution exceeded their economic ratings, thus permitting ample margin for temporary loading increases, subject to voltage drop. Attention must be paid, however, to the adequacy of jumper and terminal connections, the effect of temperature on sag and the ratings of cables in series.

Overload ratings were not assigned to switchgear manufactured to British standards; for ambient temperatures more onerous than the basic figures the current rating must be reduced. Cyclic rating of switchgear was of little value, since parts subject to heating attained working temperatures relatively quickly.

Other contributors to the discussion pointed out that while persistent overloading was bad economically, emergency operation of transformers at 130 per cent load might be sound if it saved the installation of a stand-by. Temperatures made feasible by the use of non-inflammable oils might correspond to prohibitive iron and copper losses. The thermal time-constant of a transformer might be three hours, against ten minutes for unarmoured cables and fifty minutes for armoured cables in series with it.

Installation Testing

NEW SET FOR USE BY INSPECTORS

By A. J. Baggott, A.M.I.E.E.

QUITE correctly, greater importance has been given to earth-loop testing by the requirements and recommendations of the recently published 13th Edition of the I.E.E. Wiring Regulations, in which Reg. 507 specifically requires that every completed installation shall be tested by means of an earth-loop impedance test set. This requirement goes further than that contained in the previous edition, in which it was said to be sufficient that the impedance of the earth continuity conductor on the consumer's installation from any earthed point to the main installation earth should not exceed one ohm. Those concerned with the testing of installations who have used instruments of the "Megger" and ohmmeter type, both of which use d.c. as a voltage source, will no doubt appreciate the need for a new self-contained test set which will cover all their requirements.

Fig. 1.—General view of combined impedance and insulation test set

Such an instrument should facilitate the complete testing of an installation to satisfy the requirements of the new Regulations. It should be housed in a small portable case and have the following features:—

(*a*) The means of measurement of insulation resistance.
(*b*) The means of measurement of the impedance of the earth conductor.
(*c*) The means of measurement of the total impedance of the combined neutral-to-earth circuit.

In further detail, the voltage conditions for test (*a*) should be 500 V d.c. and for (*b*) and (*c*) an a.c. voltage of such a value that the test current is $1\frac{1}{2}$ times the rating of the sub-circuit, up to a maximum of 25 A. In any given circumstance this latter figure of current, of course, will vary with the earth impedance, as it will also with the value of the neutral-to-earth voltage.

A test set has been designed to accommodate these requirements and it is essentially mains driven. The completed test set is shown in Fig. 1 and details of its top panel are given in Fig. 2. The set is housed in an aluminium case fitted with lid and shoulder straps for the convenience of the operator and has a weight of 11 lb. Its overall dimensions are 8in by 6in by 6in. Sufficient depth is incorporated in the lid so that probes and leads can be carried, although it has since been thought that the side compartment arrangement shown on the drawing is preferable as this will additionally carry a variety of adaptors to facilitate testing on site.

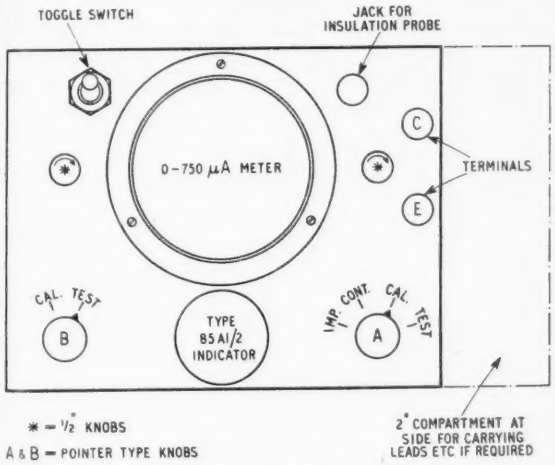


Fig. 2.—Arrangement of the top panel

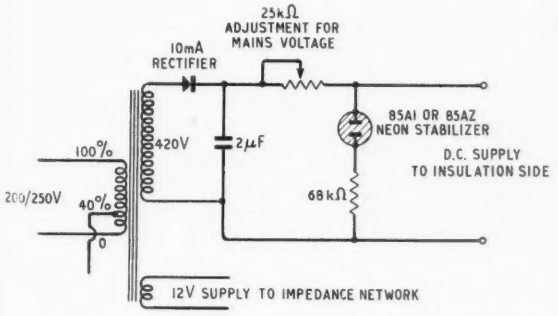


Fig. 3.—Circuit of the power supply unit incorporated in the instrument

Power Supply

The instrument is fed from the mains and the details of the supplies for each of the sections are shown in Fig. 3. It will operate satisfactorily on mains voltages between 200 V and 250 V without changing its accuracy or performance characteristics.

On the primary side of the main transformer a tapping taken at 40 per cent along the length of the winding and brought out separately is used to feed a probe network, which facilitates the correct connection of neutral-to-earth. This device will be described later, in more detail.

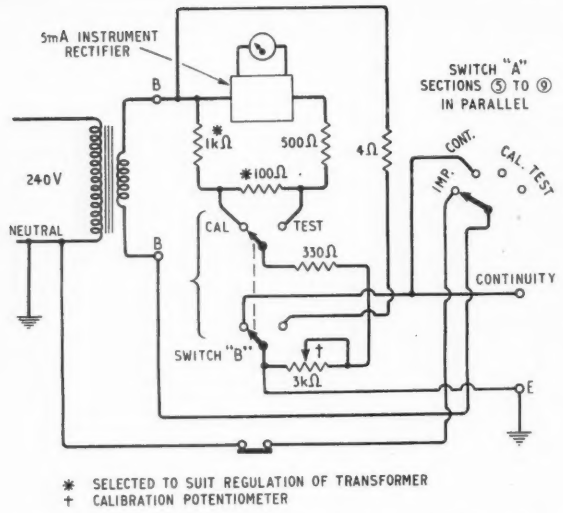


Fig. 4.—Circuit arrangement of the continuity and neutral loop impedance section

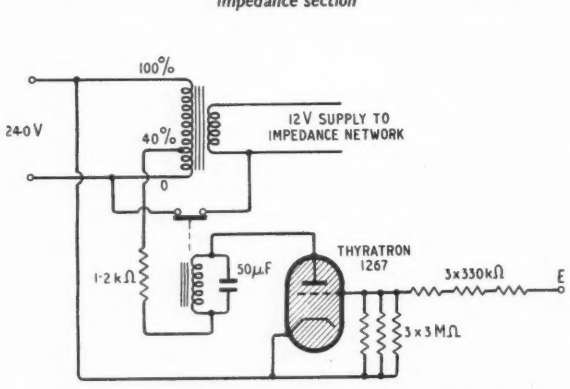


Fig. 5.—This probe network arrangement ensures against connecting the wrong side of the supply system to earth

On the insulation test side there is a winding giving a nominal voltage of 420 V and this is rectified and smoothed, giving a final output of 500 V d.c. which feeds the measurement network. To compensate for variations in voltages a 25 kΩ variable resistor is incorporated, which compensates for the various voltages that are met on site. Across this d.c. output is also connected a high stability neon stabilizer and series resistor, the voltage across the neon being used for feedback purposes associated with a scale opening technique which will be described later. On the continuity and loop impedance side there is a separate winding, nominally at 12 V, to supply current for this measurement.

The supply for the continuity measurement is nominally 12 V and is adjusted to a given level by a 3 kΩ variable resistor (see Fig. 4) which accommodates the mains voltage available at the testing position. To calibrate the test set a circuit is made via the "Continuity" position of switch "A" and the "Calibration" position of switch "B," in which positions the outgoing terminals ("Continuity" and "Earth") are short circuited. In this arrangement the measurement voltage appears across the 1 kΩ resistor and this is fed to a resistor network and a rectifier which in turn feeds a 750 μA moving coil instrument. When this resistor combination is adjusted correctly, the instrument will give full scale deflection. To measure impedance switch "B" is moved into the "Test" position which connects the 12 V winding through a 4 Ω resistor to the earth conductor under test via the output terminations "Continuity" and "Earth." In this arrangement the voltage across the 4 Ω resistor now feeds the instrument through the previously adjusted resistor network. This voltage is a percentage of the total and its value is proportional to the impedance of the conductor under test. When suitably scaled in ohms the instrument will indicate directly the impedance of the circuit under test.

For simplicity, in the test described a supply voltage of 12 V and a series resistor of 4 Ω are used which give an average current of about 3 A. Thus, if the constant of these two circuits is adjusted, different values of current can be used to suit the particular circuit under test.

In the test described the current conditions under "Test" and "Calibrate" are not identical and the instrument network has to be adjusted to accommodate the regulation of the supply transformer. This is achieved automatically by switch "B," which compensates by means of a resistor network on the instrument side.

The conditions for the measurement of the total loop circuit are different from the above only in so far as the measurement voltage is different. In this case, as the voltage of the neutral above earth varies, depending upon mains system arrangements, the total voltage employed will vary. In the test set the voltage from the secondary winding is summated with any existing above-earth potential of the neutral. To achieve suitable conditions for the test, the neutral end of the primary winding is connected via the "Impedance" position of switch "A" to one end of the 12 V winding, the other end of which winding is connected via the previously described instrument resistor network to "Earth." The current circuit is completed by the neutral of the mains system. Obviously, some safeguards must be made to prevent a wrong connection and in the test set means are incorporated to ensure that it is impossible to connect the wrong side of the supply system to earth.

In common with the continuity measurement the calibration of the test set is achieved by adjusting the secondary voltage (this includes the neutral-to-earth voltage) to give full scale deflection of the instrument. In the measurement of the earth-loop impedance the summated voltage is connected via the 4 Ω resistor to the neutral earth loop and the instrument network is connected, as in the continuity measurement, across the 4 Ω resistor. Again the voltage across the resistor is proportional to the impedance of the circuit which is being tested and with suitable calibration of the scale the instrument indicates directly in ohms.

Mention has been made of the voltage which sometimes exists between the neutral and earth; on occasions this can be as high as 8 V. In this test set such a value of voltage can be accommodated, although if the neutral-earth voltage rises above this value it will not be possible to obtain in a single measurement the combined impedance of the loop neutral circuit. In this unlikely circumstance, the determination of the total impedance of this loop circuit will involve two tests:—(*a*) the continuity of the circuits on the consumer's side and (*b*) loop impedance of the earth-to-neutral circuit on the supply side. Although these high voltages can be encountered, the average rarely exceeds 5 V.

It was mentioned earlier that to measure the impedance of the neutral-to-earth loop circuit, the neutral side of the mains transformer had to be connected via the instrument to earth. In the test set this condition is achieved in such a way that automatically (if a measurement is possible) the conditions for test are correct. This discriminating device (see Fig. 5) consists of a cold cathode thyratron

which is fed from the 40 per cent tapping on the primary side of the mains transformer. The anode circuit of the thyratron contains a limiting resistor and also the operating coil (shunted by a condenser) of the Post Office type relay whose contacts connect the neutral side of the mains transformer to earth via the instrument. The grid of the thyratron is connected by a resistor network to earth. The probe and grid resistors are important and these are fitted in the test set in triplicate as shown.

When a supply is connected to the test set in preparation for making a measurement it is unlikely that the polarity will be known. If a condition exists where the polarity is correct, the grid of the thyratron accepts voltage relative to the cathode of about 30 per cent of the supply voltage (this is provided by the resistor network). In this condition ionization of the thyratron will take place and the gap will break down between the anode and cathode and the P.O. relay will operate. If the polarity is incorrect the grid of the thyratron will be held at cathode potential and ionization will be impossible.

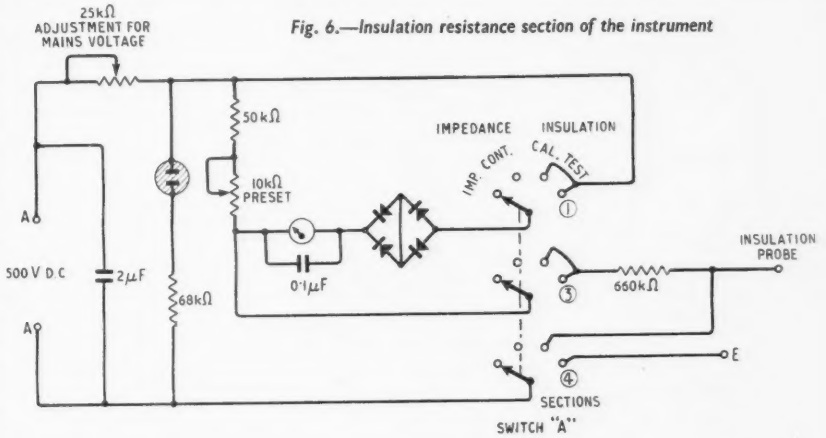
The supply for the insulation resistance section (see Fig. 6) is 500 V d.c. and is taken from the 2 μF reservoir capacitor through a 25 kΩ variable resistor which, as mentioned before, is used to accommodate variations in the mains voltage. This resistor is adjusted to give full scale deflection of the instrument when switch "A" is moved into the insulation "Calibrate" position. The load resistance on this section is 660 kΩ and the insulation resistance of the circuit under test is compared with this value when switch "A" is in the test position. Under these conditions the voltage developed across the instrument network is proportional to the resistance of the circuit under test and by suitable calibration of the scale the instrument can be made to read directly in ohms.

The test set instrument is required to indicate in ohms the insulation resistance and impedance of the earth circuit and therefore two directly calibrated scales are needed. On the insulation side 1 MΩ has been chosen as the centre point on the scale and this calibration point is determined by the 600 kΩ series resistor. On the impedance side this direct method cannot be used, as the 4 Ω series resistor in the case described has only been fixed to limit the current flow in the circuit and using the simple method described for the insulation side, the scaling of the indicating instrument would be very poor. To overcome this difficulty and to open up the scale, compensation by means of feedback is used as shown in Fig. 7. The source of this feedback voltage is from the neon stabilizer which gives a constant output voltage irrespective of the input conditions. This negative voltage feeds the instrument and the current is adjusted to give a feedback figure of $-1{\cdot}5$ mA. With this technique a scale shape is achieved which devotes 50 per cent of the scale length in the 0-1·0 Ω measurement without prejudice to the current circuit conditions for the impedance measurement which, as described before, feeds the instrument from the voltage developed across the 4 Ω series resistor. The value of this voltage, having regard to the feedback previously mentioned, is directly proportional to the impedance in series with the 4 Ω resistor so the scale can be calibrated in ohms.

A further feature to be considered is that the mains transformer has a certain percentage regulation and as the current conditions in the "Calibrate" and "Test" positions of switch "B" are different some compensation is required. This is achieved by the resistor network which as shown makes automatic compensation when switch "B" is moved from the "Calibrate" position to the "Test" position.

A small capacitor is connected across the instrument to

Fig. 6.—Insulation resistance section of the instrument



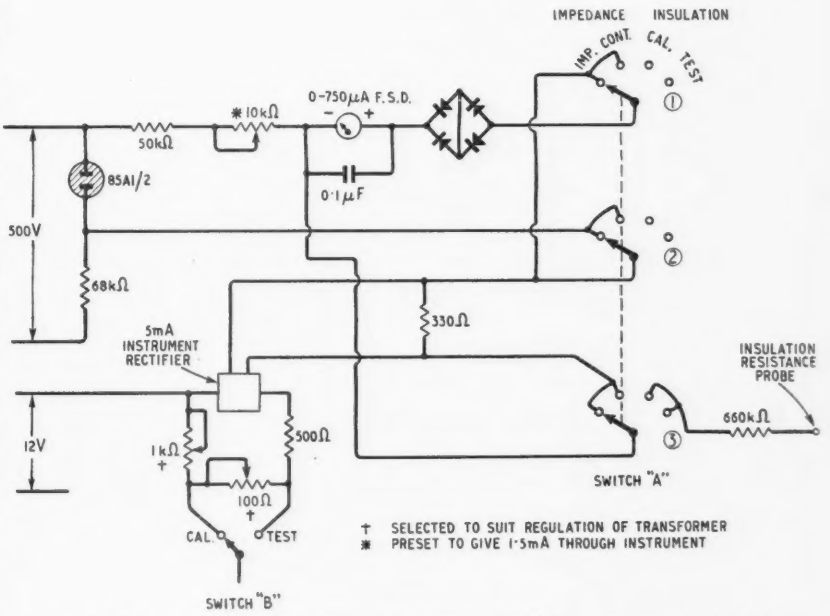


Fig. 7.—The indicating instrument network incorporates a feedback arrangement to open out the impedance scale

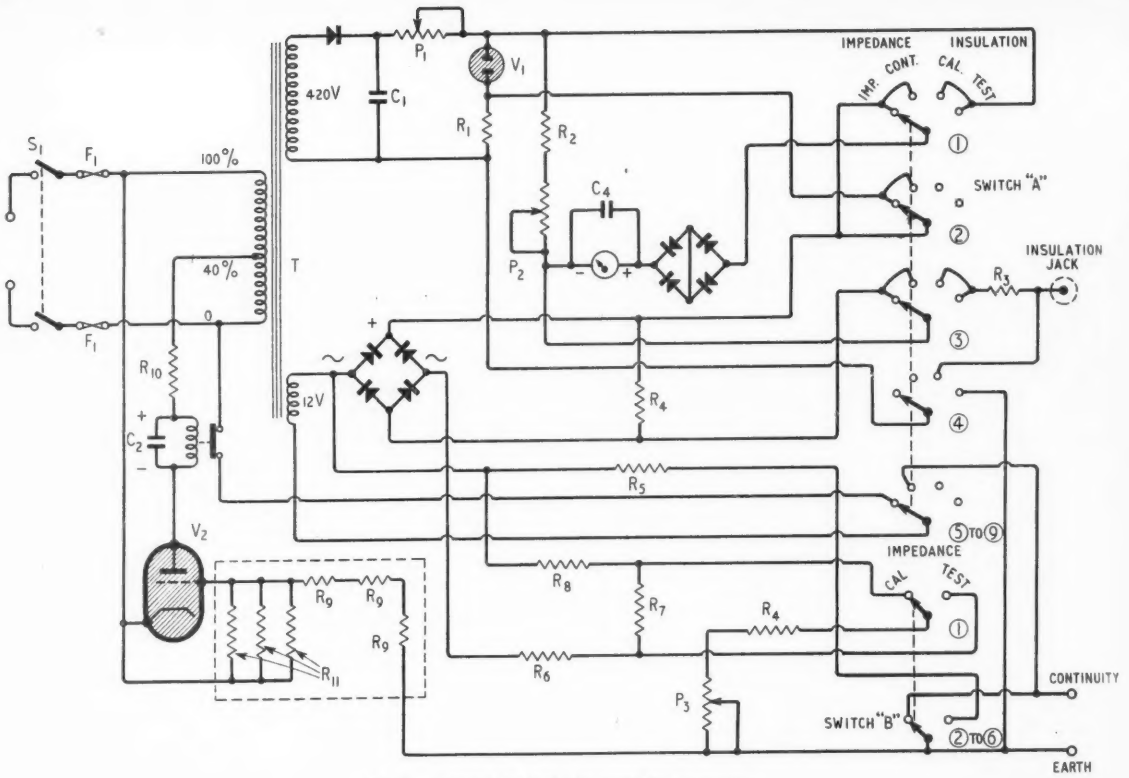


Fig. 8.—Circuit details of the complete instrument

damp out any rapid changes in mains voltage during the test and also to minimize the effect of any a.c. ripple which is present from the rectifier.

The complete circuit diagram of the test set is shown in Fig. 8 together with all its details and component values. A prototype of this design has been in use since 1952 under various conditions and has been entirely suitable for the measurement of insulation resistance, continuity and loop neutral to earth impedance. A feature that was not accommodated in the design, and which is thought to be necessary, is a compartment attached to the body of the test set which can accommodate the different types of plugs met on circuit. Further, some common means of connection, such as plugs with adjustable pins so that the various types of sockets on circuit can be quickly connected up, is thought to be desirable.

Instruments for Arduous Service

DESIGN and use of electrical measuring instruments under severe conditions of vibration, shock and climate were discussed at the Institution of Electrical Engineers (Measurement and Control Section) on 31st January. Dealing with design, Mr. C. A. Oldham said that the more pronounced problems were associated with the moving elements; while the strength/mass ratio should be as high as possible, this was often circumscribed by other functional requirements which took in resilient mounts, shock absorbers and bearings. Temperature presented perhaps the most difficult problems, among them being compensation of characteristics and the destructive effects of humidity. Ranges of -50 to $+70$ deg C were currently specified and -70 to $+100$ deg C were proposed. Standardization of hermetically sealed instruments was a controversial subject. Such instruments cost more and were more difficult to maintain.

Conditions of use, Mr. G. N. Harding stated, were extremely wide, particularly for ammeters and voltmeters. Instruments might be subjected to high- or low-frequency vibration, extremes of temperature and pressure and high humidity. In the accelerated tropical exposure test, hot humid conditions were used for 84 days, equivalent to three years' service in a jungle. Vibrations over the major portion of the frequency range were usually of a circular nature, but sometimes a superimposed linear vibration caused the pointer of an indicating instrument to creep over the dial, producing a steady but incorrect reading. Experience in all climates had demonstrated the need to enclose the mechanism in a sealed case.

Some later speakers expressed preference for resilient mounting of panels rather than of instruments and for shock absorption by internal design when instruments were cramped. Reference was made to difficulties in finding materials to withstand the proposed 100 deg C tests, especially in sealed instruments. Sealing for rough service at -20 deg C was said to require metal-glass techniques, though other speakers held that rubber seals, even under heat cycling, would be satisfactory, subject to suitable restriction of the degree of compression during assembly; the possible use of silicone rubbers was also mentioned. Among other aspects discussed were the value, if any, of zero adjusters in sealed instruments and the use of desiccators.

Electric Traction Staff

POWER OPERATED DEMONSTRATION BOARDS

FOR the training of motormen and maintenance staff in the operation of the various electrical circuits encountered on electric multiple unit rolling stock, a number of novel demonstration boards have been constructed by the Chief Mechanical & Electrical Engineer's Department of the Southern Region of British Railways. In these boards, examples of which are illustrated, the diagrams are prints pasted to a plywood base and covered by vinyl acetate sheeting. The base-board is enclosed in a wooden case for carrying purposes.

Fig. 1 shows the motor and power circuits for the latest type of motor coach for the 4-car multiple unit suburban stock. In actual practice there are two motor coaches and two equipments to each unit, but only one equipment is demonstrated. The power train line, however, is shown for the two motor coaches, enabling the effect of blown power fuses to be demonstrated.

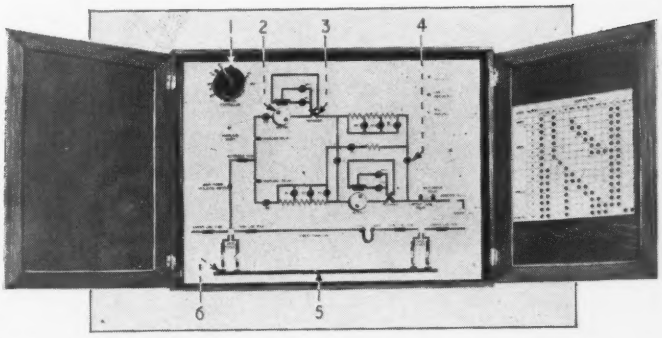


Fig. 1.—Demonstration board for the latest type of suburban motor coach

The master controller unit is fully interlocked mechanically by cams situated under the cover on the front of the board. Rotary wafer type switches provide the necessary contacts. There are switches for the simulation of the contact drum and fingers on the master controller, the reverser and the master switch. Indicator lights (4) simulate the contactors.

To avoid the use of two motors to indicate the acceleration of the traction motors, one motor is placed at the back of the board, and drives two black and white discs through reduction gears. The discs (2) are brought out to the front of the board. In series with the motor armature there is a tapped resistance, to control the speed of the discs. The motor is shunt wound, and the field is brought out so that the direction of rotation can be reversed. Control of the motor speed and the correct contactor sequence are obtained by interlocks on a series of Post Office type relays. The shunt, series, parallel and weak field notching sequence is governed by the master controller, the contactor sequence chart being mounted inside the lid on the right.

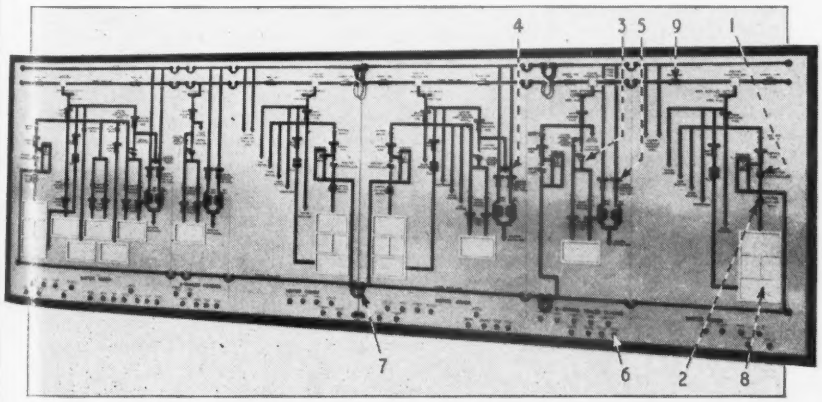
Acceleration of the motor can either be manual or automatic. The manual operation is by a push button, and each notch can be taken individually and the sequence of operations explained at leisure. Automatic acceleration, which on the motor coach itself is governed by the current limit relay, is reproduced on the board by the use of a CR timing circuit. The discharge is across a neon tube, from which the limiting resistance has been removed, into a relay coil. An "In" interlock on this relay is shunted across the manual acceleration push button to energize the relay for cutting out the motor resistance, and lighting the correct contactor lamp. A 200 V a.c. supply is fed through a half-wave rectifier for energising the CR circuit. Three rates of notching are employed to give high and low rates of acceleration and "light" operations, i.e. operation of the contactors with no current flowing through the series coil of the current limit relay or the traction motors. These different rates are obtained by altering the value of the resistance, in the CR. circuit, and the time intervals are 1·5, 0·75 and 0·2 sec respectively.

The action of the reverser on the front of the board (3) is obtained with two pairs of moving arms, one in each motor field. Each pair is attached to the armature of a relay. In Fig. 1, the relays are shown de-energized: with the relays energized, the arms will be upright. Other items of equipment which are reproduced are the control circuit governor, no-current relay and overload relay. These are controlled by either push buttons or switches situated in a control panel on the side of the board. The miniature collector shoes (6) are spring loaded so that they can be lifted from the conductor rail, and the power fuses are removable to simulate power supply interruptions.

The second board is shown in Fig. 2, and demonstrates the control and auxiliary circuits for the earlier, 1936, type multiple unit suburban stock. The compressor circuits are not shown in full as they form the subject of another board.

An eight-car train is demonstrated, made up of one four-car unit and two two-car units. The four-car equipment forms the left hand half of the board.

Fig. 2.—Board showing control and auxiliary circuits for an eight-car train



Each individual circuit terminates in a panel (8). These panels are glass fronted, and as each circuit is energized the appropriate panel lights up, displaying the name of each circuit, e.g. control, potentiometer, route indicator, etc.

On the extreme left of the board, the complete schematic circuit for a motor coach is shown, with the exception of the compressor circuit, for reasons already explained. Subsequent motor coach circuits are not reproduced in full as they are an exact replica. The lighting circuit

is duplicated on the third motor coach to demonstrate the tripping and setting arrangements for the lighting contactor, but the control circuits are complete throughout since this circuit is common to the whole train and a fault on it may cause a great deal of trouble and delay.

One complete trailer coach circuit is shown, with the exception of the coach heating circuit, which is the same as for the motor coach. Rotary wafer type switches, are used for the master controllers, and also for the control cut out switches. One detachable master controller handle only is used on the board, and a mechanical locking arrangement ensures that the handle cannot be removed from any controller whilst it is in the "on" position. For demonstration purposes, it is only necessary to have "off" and "on" positions of the controller.

The lighting contactors have fixed and moving arms on the front of the board (3). The moving arm is attached to the armature of a small relay. Each assembly consists of two relays, interlocked mechanically, operation being controlled by a lighting trip and set switch (4) of the key type.

On this particular type of stock, all 660 V fuses, with the exception of the shoe and power train line fuses (9) are of the indicating type. This feature has been simulated on the board by having two lights (5) one red and the other green situated on either side of the fuse. When a circuit switch is closed, and providing the appropriate panel is illuminated indicating that the circuit is functioning correctly, the green light will show.

To teach the staff the correct method of fault location and rectification, it is possible to put on artificial faults by means of fault switches (6) at the bottom of the board. Each fuse has its own fault switch, and when the switch is operated it causes the fuse indicator light to change from green to red, indicating a blown fuse.

The correct procedure for isolating the circuit before changing the fuse is demonstrated, and if an intermittent fault is intended, the fault switch is cancelled before closing the circuit switch again. When the latter is closed the green light will show. But if a permanent fault is to be demonstrated the fault switch is not cancelled and when the circuit switch is closed the red light persists.

With multiple-unit stock, it sometimes happens that faults occur on the control train line cables as well as on the equipment itself. Both types of faults can be demonstrated singly or together, and the circuits are arranged so that the fault will persist until it has been correctly isolated, either by taking down the inter-unit jumpers (7) or isolating the faulty equipment by opening the correct control cut out switch (2).

It is considered that these boards are of great use to the maintenance staff and motormen since they present a complete reproduction of most of what actually happens on the vehicle.

Lighting Problems

THE meeting of the Birmingham Centre of the Illuminating Engineering Society on 27th January was devoted to the reading of papers by members under the heading of "My Most Interesting Lighting Problem".

The first speaker, Mr. H. F. Truman, discussed the lighting of the Walsall Arboretum. The talk, illustrated by many coloured slides, dealt with the treatment, by coloured floodlights, of woodland scenes, fountains, pools and waterfalls together with cut-outs from nursery rhymes irradiated by ultra-violet light.

Mr. R. C. Willdey dealt with problems in the lighting of a large motor-car showroom converted from a warehouse and lock-up shops. A false ceiling to cover the mass of irregularly placed beams which composed the ceiling, a suspended soffit to "tie up" the vertical columns, and built-in provision for window lighting all contributed to the excellent final result.

Mr. G. R. Hanson, chairman of the Centre, read a paper on the lighting of a foundry prepared by Dr. E. H. Norgrove, who was unable to be present owing to illness. Dr. Norgrove's approach to the problem was to obtain the best lighting for the job at the lowest cost. Consultation with the people working in the foundry, examination of the economics of the scheme, and installation of different types of lighting in test sections of the building finally produced an answer which satisfied all parties concerned.

This was followed by a paper on the lighting of an insurance office by Mr. K. F. Haylor. Natural light was practically non-existent and restrictions imposed by the architect determined the type of lamps to be used. By the addition of false ceilings, with lighting fittings housing both tungsten and cold cathode lamps, and with specially modified fluorescent fittings in certain areas, a most pleasing and efficient lighting scheme resulted.

The last paper, presented by Mr. W. G. Whitaker, dealt with the floodlighting of Chatsworth House and gardens. The charm of this fine old house and gardens was well illustrated by slides, the illumination greatly adding to the beauty of the estate which possesses some of the finest vistas in the world.

Tin Research Report

THE annual report of the Tin Research Institute, Fraser Road, Greenford, Middlesex, for 1955 deals fully with the progress of research work on hot-tinning, tinplate, soldering, electro-deposition, metallurgy and organo-tin compounds. There is a large section devoted to the Institute's activities at conferences, lectures, exhibitions and in broadcasts and films. Another main section of the report reviews activity in each of the Institute's overseas branches in Belgium, Canada, France, Germany, Holland, Italy, Sweden and the U.S.A. There are also a list of the scientific papers which originated at the Institute during the past year and a long list of articles contributed to the technical Press.

An improved method of tinning cast iron was developed during the year and is known as the "direct chloride" method. Tinplate researches were successful in producing a new test for assessing the ability of tinplate to resist rusting due to the atmosphere. Studies were continued on the flow-brightening of electrolytic tinplate. The electrodeposition of tin and its alloys has received further study and the tin-zinc and tin-nickel alloys are gaining ground in industry throughout the world. The value of a thin flash of electro-tin as a protective plating over steel which is subsequently to be painted is now becoming more appreciated. Systematic research into the mode of action of addition agents in tin and tin-alloy plating baths has continued.

The Institute's metallurgical researches have been concerned with the perfecting of certain techniques in the production of the aluminium-tin bearing which was invented in the Institute a year or two ago. Organo-tin compounds are being studied on behalf of the Institute at Utrecht by a team of five persons. Six papers and a thesis on methods of preparation and the properties of organo-tin compounds, particularly the anti-fungal uses of such compounds have now been completed. In these researches and in the development of applications for the organo-tin compounds the Institute is being ably assisted by both academic and industrial research groups in many other countries.

A copy of the report (Publication No 248) is available from the Institute free of charge.

HEAT TREATMENT PRACTICE

THE Metallurgy (General) Division of the British Iron and Steel Research Association is organizing a conference on heat treatment practice, to be held at Ashorne Hill, Leamington Spa, on 5th and 6th June. Emphasis will be given to the consideration of practical problems connected with the heat treatment of steel products, from small engineering components to large forgings.

WORLD ELECTRICAL MARKETS

Western Germany

By R. E. KAAN, Dipl.Ing.

ONE generally is inclined to think about Western Germany only as a formidable, ever-growing competitor, not as a highly selective, but desirable market for United Kingdom electrical products. The successful German revival has been the product of extreme hard work, Allied help, and ingenious self-financing. Though the present boom, with its manifestation of high level productivity, is being accompanied by wage-price spirals, overheated capital investment, and other economic disorders, the Germans themselves are most optimistic about their future. The Ministry of Economics as champion of free enterprise, is applying checks to the inflationary trend, by stimulating imports to keep home prices steady, and by halving the tariffs on some hundred classes of capital equipment, agricultural machinery and building materials.

An analysis of the German electrical foreign trade figures shows that the ratio of Germany's electrical imports to her exports were 9·7 : 100 during 1954 against 8·4 : 100 in 1953. While her exports grew by 35 per cent, from £105 million in 1953 to £141 million in 1954, her electrical imports rose by no less than 52 per cent from £8·8 million in 1953 to £13·6 million in 1954. The main suppliers of electrical goods and apparatus in order of their importance are shown in Table 1.

Table 1.—Main suppliers of electrical goods to Western Germany
Percentage of total electrical imports

Countries	1954	1953
Holland	30·2	37·3
United States	16·3	8·0
Switzerland	16·0	21·4
United Kingdom	12·4	9·7
Denmark	4·3	3·1
Saar	4·1	4·4
Belgo-Luxemburg	3·3	3·2
France	3·2	4·5

Holland, being her northerly neighbour and most important electrical market, took £14·1 million, or 10 per cent of West German exports, while she herself exported £3·9 million worth, mainly electronic products, to Western Germany. Switzerland lost ground in exports of power station equipment; the United States, however, gained considerably by sending larger supplies of domestic and electronic equipment. Table 2 shows the steep increase of domestic appliance imports compared with other commodities.

Table 2.—Western German electrical imports
Percentage of total electrical imports

Commodity Group	1954	1953
Domestic appliances	11·9	7·8
Electronic tubes	10·4	13·6
Radio transmitters and receivers	8·4	9·2
Motors and generators	6·6	8·7
Electrical measuring instruments	5·0	5·1
Dry shavers and hairclippers	4·6	4·9
Controllers, regulators and resistances	4·4	3·2
Switchgear	3·6	3·7
Welding equipment	2·4	3·4

With the great increase in income, the demand for household goods has recently grown vigorously and outpaced even enlarged local manufacture.

Though United Kingdom electrical exports to Western Germany have lately been rising, as shown in Table 3, the British share could be larger. While Western German exports to the United Kingdom during the first half of this year amounted nearly to the total value of 1954, trade in the opposite direction increased on a much smaller scale.

Table 3.—United Kingdom–Western Germany Electrical Trade

Exporting Country	Year	Value in £m
United Kingdom	1953	0·8
United Kingdom	1954	1·6
United Kingdom	First half 1955	0·9
Western Germany	1953	1·3
Western Germany	1954	2·4
Western Germany	First half 1955	2·3

The United Kingdom manufacturer contemplating marketing his products in Western Germany, should take full advantage of the present demand for domestic appliances, which is still growing by reason of the large-scale building programmes. The same considerations can be applied to radio and TV receivers and components (Table 4).

Table 4.—United Kingdom Electrical Exports to Western Germany

Class	1954 (£000)	First 9 months 1955 (£000)
Generators	142	75
Motors	20	10
Transformers	0·7	15
Switchgear	20	2
Control gear	5	30
Welding apparatus and electrodes	15	13
Domestic appliances except refrigerators	235	451
Refrigerators	319	194
Fans	13	6
Instruments and meters	59	78
X-ray and medical apparatus	15	17
Radio and TV receivers and transmitters	627	629

The British exporter has to-day a better chance of gaining a foothold in the German market than in the past few years. The coming Hanover Fair (29th April-8th May) should offer an excellent opportunity for any contemplated start on this very selective and competitive market.

North Hessary Tor Television Station

The permanent and higher-powered television transmitters at the B.B.C's. North Hessary Tor station in South Devon were brought into service on 15th February, replacing the temporary low-power transmitters which have been in operation since December, 1954. The transmissions will continue to be on Channel 2 (vision 51.75 Mc/s, sound 48.25 Mc/s) with vertical polarization. The new transmitters will for the time being use the temporary aerial.

INDUSTRIAL NEWS

Iron and Steel Goods Exports

There is a control over the export of certain iron and steel goods in order to ensure that scrap metal is retained in the United Kingdom. In this connection the Board of Trade announces that the open general licence which authorizes the export of certain iron and steel goods valued at more than £25 per ton has been revoked and replaced by a new open general licence which raises this value limit to more than £35 per ton. This licence came into operation on 15th February, from which date individual licences are required for exports where the value is £35 per ton or less. The iron and steel goods are those specified in Group 6(2) of the First Schedule to the Export of Goods (Control) (Consolidation) Order, 1955. Inquiries regarding this licence should be made to the Export Licensing Branch, Atlantic House, Holborn Viaduct, E.C.1, (telephone: City 5733). Copies of the Open General Licence (price 2d each, by post 3½d each) may be obtained from H.M. Stationery Office. The licence does not apply to exports to China, Macao, North Viet Nam or Tibet.

Transformers for Salisbury, S. Rhodesia

Mr. G. B. Proctor, managing director of Transformers (Watford), Ltd., has recently returned to this country from a trip to East Africa and Southern Rhodesia. His company is supplying the station and unit auxiliary transformers for the new City of Salisbury No. 3 power station, and Mr. Proctor's visit coincided with the arrival on site of the first of these units, as shown in the accompanying picture. The erection of many new multi-storied modern buildings which, in the absence of competitive forms of light, heat and power, are all-electric, gives rise to a heavy concentrated load with a high peak/average demand factor. These skyscraper-type buildings are each supplied from a sub-station in the basement, and Transformers (Watford) Ltd., has been awarded a contract by the City of Salisbury for the supply of 22 dry type, air cooled, class "H" transformers ranging in size from 300 to 1,000 kVA for installation in the basement sub-stations of these new buildings.

H.V. Cable for Canada

Pirelli-General Cable Works, Ltd., an associated company of the General Electric Co., Ltd., has received a repeat order through its Canadian affiliate, the British General Electric Co. (Canadian), Ltd., for the manufacture and installation of three further lengths of 301 kV oil-filled power cable, total length approximately 6,000ft of cable, from the Aluminum Co., of Canada, Ltd. The cable is required for the Kemano-Kitimat project for which Pirelli-General Cable Works in 1954 supplied and installed a complete three-phase circuit of three single-core cables. The new circuit will deal with the additional power being brought into service from the subterranean power-house at Kemano. As in the previous installation, the cables will run through a 670yd long tunnel to the terminal of the overhead line which delivers power to the electrolytic refining plant at Kitimat, 50 miles away.

A new paper-lapping machine used in the manufacture of these cables was described in the *Electrical Review* of 3rd February.

States Library, St. Helier

The Jersey Electricity Co., Ltd., has recently put in a complete new lighting scheme in the public library situated in the States Offices, St. Helier. Before this installation, great difficulty was experienced in reading book titles, particularly in the alcoves of the room, and also in reading the magazines and newspapers on the tables downstairs and the upstairs stands. The fittings were designed by Troughton & Young, Ltd. Not only is there ample lighting, but the fittings blend with the architecture of the room.

The new lighting fittings in the public library in the States Offices, St. Helier

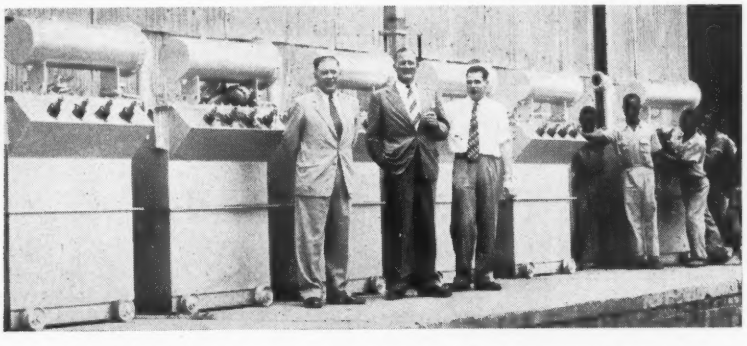
Timed Cooking

During the recent Electrical Housecraft Advisers' Conference the Simplex Electric Co., Ltd., invited delegates to an "at home" at 45, Park Lane, London, W.1. The evening's principal item was a demonstration by Miss Joan Whitgift of electric cooking under timer control, her aim being to show that no special technique was involved—"timed cooking was just cooking." A point which was emphasized was the ability to cook complete meals in this way without anything more than the correct placing of the individual items in the oven.

Miss Whitgift's demonstration, which was prefaced with a speech of welcome from Mr. E. G. Plucknett, director and joint general manager of Simplex, was most entertaining as well as instructive.

Conditions in Iron Foundries

The Joint Standing Committee for Conditions in Iron Foundries in its first report published on 7th February (H.M. Stationery Office 4s. 6d.) wants the results of research work into the prevention of industrial diseases in foundries more widely known and what is more important, put into practice in the foundry. The Committee also calls for a reduction in foundry accidents by a determined attack on the main causes—the



Batch of 150 kVA, 11 kV transformers arriving at the Central Municipal Stores, Salisbury, Southern Rhodesia. In the picture (left to right) are: Mr. R. Harris (Rhodelect, Ltd.), Mr. G. B. Proctor (Transformers (Watford), Ltd.) and Mr. C. Woods (City of Salisbury)

handling of articles and the movement of molten metal. The Report gives a summary of the conclusions reached in the first comprehensive investigation into the pulmonary risks of iron and steel foundry workers and outlines the activities of employers, trade unions and the Government. Sections are devoted to the various kinds of dust determinations, dust observation and photography, dust estimation and dust standards. General consideration is given to problems affecting dust suppression. The various forms of dust control are described.

Scottish Dairy Show

Electrical equipment for use on a typical dairy farm having a herd of 30 cows was shown on the joint exhibit by the Electrical Development Association and the South of Scotland Electricity Board at the Scottish Dairy Show held this week at Kelvin Hall, Glasgow. One section of the stand showed appliances for providing hot water, steam sterilizing and chilled water milk cooling for in-bucket milking of a herd. The use of electricity for feed preparation was the subject of a display including a combined milling outfit and a vertical mixer. Infra-red lamps, both bright and dull emitters, together with enlarged photographs illustrating this application of electricity were also shown. Attention was also directed to the use of electric pumps for providing farm water supplies, by the display of a sectional model of an electric domestic piston pump, and a submersible pump for wells or boreholes. A section of the stand headed "Electricity Aids Crop Conservating" displayed a series of enlarged photographs of electric barn hay-drying, multi-purpose drying and grain drying installations. Equipment for cooking, water heating and laundry work in the farmhouse was also demonstrated.

Cable Making Industry Wages

The Joint Industrial Council for the Electrical Cablemaking Industry has announced that, as from the beginning of the first full pay period following 4th February, the timeworkers' rates of wages, as set out in Schedule II of the J.I.C. agreements, have been increased by 2½d an hour, or 9s 2d a week of 44 hours, in respect of adult males, and by 2d an hour, or 7s 4d a week of 44 hours, in respect of adult females. For timeworkers below the adult age the increases vary from 1d an hour at the age of fifteen to 2¼d an hour at the age of 20 for males, and from 1d an hour at the age of fifteen to 1½d an hour at the age of seventeen for females. These advances apply to all workers whether paid on time rates, on payment by results or otherwise.

Gauge and Tool Makers' Luncheon

The President of the Board of Trade (Mr. Peter Thorneycroft) was the guest of honour at the trade luncheon in London of the Gauge and Tool Makers' Association on 8th February, with Mr. F. W. Halliwell, C.B.E., president, in the chair.

In introducing Mr. Thorneycroft, Mr. Halliwell said the work of the toolmaker was the genesis of automation — automation was a term which had been overworked. The gauge and tool industry was a key industry and he stressed that as such its importance to the export trade was paramount. Inflation was the greatest threat to the industry and social life of the nation and the position was not helped by the upward spiral of wages.

Mr. Thorneycroft said that the gauge and tool industry had grown from one in which the products were mainly imported to one in which the products were now mainly made at home.

In place of Mr. L.E. Van Moppes, chairman of the Association, Mr. H. S. Holden, M.I.Prod.E., proposed the toast "Our Guests". He said the object of all of us was to ensure that our standard of life was upheld. If Whitehall looked to the City and the City looked to industry to solve the main national problem, we should not entirely solve it. A country like ours which lived on its exports should give its customers a fair chance. When Governments had discharged all their responsibilities the main role rested with industry. Sir Graham Cunningham, K.B.E., responded for the guests.

Engineering Training

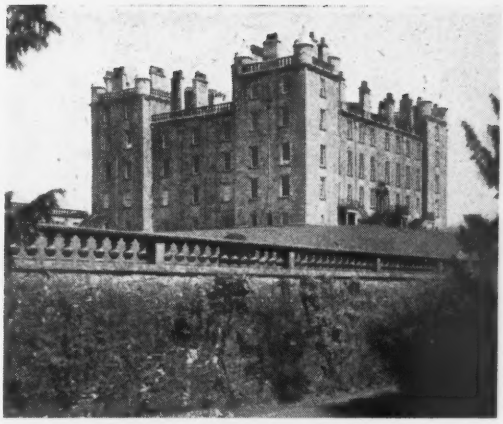
From the Belmos Co., Ltd., we have received a well-produced illustrated booklet entitled "Training for Careers in Electrical Engineering." It sets out the facilities offered by the company, at its factories at Bellshill and Blantyre, Lanarkshire, for the training of engineers, both electrical and mechanical, to craft, technical and professional standards.

Overseas Cable Orders

Wandleside Cableworks, Ltd., has received contracts from the Government of India for over £100,000, which together with other orders from overseas governments and supply authorities total over £250,000 since 1st January.

Drumlanrig Castle Rewired

Drumlanrig Castle, Dumfriesshire, seat of the Duke of Buccleuch and Queensberry, has recently been rewired and some 600 lighting points installed, the contractors being P. Drummond & Sons (Electric), Ltd., of Dumfries. Some 29,000yd of h.v. and l.v. vulcanized-rubber-insulated cable manufactured by British Insulated Callender's Cables, Ltd., was used in the rewiring of the castle. To limit voltage drop the high voltage supply was transferred from outbuildings to the castle approach, the underground cable work being carried out by British Insulated Callender's Construction Co., Ltd., for the South of Scotland Electricity Board.



Drumlanrig Castle, Dumfriesshire, which has recently been rewired

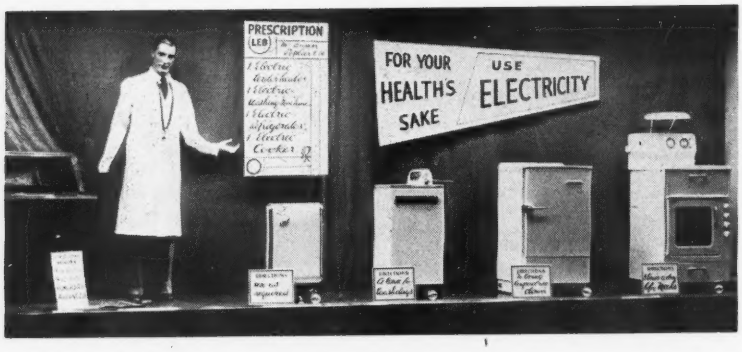
Bristol Catering Exhibition

Following the introduction of a special rate of 1½d per kWh for electricity used in commercial cooking and food preparation, the South Western Electricity Board is holding an exhibition of all types of commercial cooking and ancillary catering equipment at Electricity House, Bristol, from 6th to 17th March. It will cover the interests of a wide range of caterers, from the small boarding house keeper to the largest hotel, school and industrial canteen. Many types of snack-bar and fish frying equipment will also be exhibited. The latter will include a range incorporating infra-red principles. Many of the exhibits will be publicly demonstrated and short talks and illustrated lectures are to be given.

Engineering Training Scheme

The Richardsons Westgarth Group announces that it has introduced a new recruitment and training scheme for every level of apprenticeship, the principal purpose of which is to encourage every type of school to take advantage of opportunities for boys of varying grades of ability, to make for themselves successful careers within the Group's framework. Craft apprentices will continue mainly to be recruited from secondary modern schools with day release privileges available for technical studies.

Two new apprenticeship schemes have been introduced—technical and student. The technical apprenticeship recruits from secondary grammar and technical schools with an intake of boys of General Certificate of



Poplar Service Centre display which gained first place in the London Electricity Board's window dressing competition

Education ordinary level standard. Promotion is available in this grade to Higher National Diploma apprenticeship and there are opportunities for proceeding to a degree course. The student apprenticeship recruits boys from grammar and public schools with engineering interests who have reached advanced level standard in the General Certificate of Education. A normal apprenticeship will still be offered with the chances of proceeding to university, as part of the training. Furthermore, generous assistance will be available, if needed.

To meet its present needs, the graduate-engineer apprenticeship now becomes an integral part of the Group's training policy and opportunities are offered for both mechanical and electrical graduates to serve two years of specialized training, leading to highly responsible positions on the Group's staff.

Service Centre Competitions

The South Western Electricity Board's display competition for large service centres has been won by Taunton Service Centre, whose winning team will be presented with the Frank Forrest trophy. This trophy has been presented by Mrs. Forrest to commemorate her late husband's long association with electrical development, latterly as a member of the South Western Electricity Board. It will be held for a year by Taunton, who won the display competition for service centres of all sizes last year. The second prize has been awarded to Plymouth Service Centre (Devon Sub-Area) and third place to Bath (Bristol Sub-Area). The theme for the interior displays in the competition was "The Four Foundations of Modern Living"—electric water-heating, cooking, refrigeration and washing.

L.E.B. Window Dressing Competition

The London Electricity Board held its fifth annual window dressing competition in 1955. The theme selected was "Electricity and Health". A preliminary judging panel of senior officers of the Board selected entries for submission to the final judges who were Mr. C. Tullberg, display manager, Selfridges, Ltd., and Mr. A. J. Symes, Editor of *Display, Design and Presentation*. The awards were as follows:—1st place, Poplar Service Centre; 2nd place, Hackney Service Centre; and 3rd place, Walthamstow Service Centre. The shield and certificates were presented to the winners by Mr. H. J. Randall, chairman of the Board, in the presence of members of the board.

Television in Canada

Seventeen new television stations were established in Canada in 1954-55 (two C.B.C. and 15 privately owned affiliated stations). This is stated in the annual report of the Canadian Broadcasting Corporation. Some 700,000 new sets were bought during the year, making the total number in use 1,400,000. The report says that the privately owned stations are playing an increasingly important part by providing distribution facilities for the national programme in many areas. During the year the C.B.C. made arrangements with communication companies for direct relay T.V. network facilities from coast to coast.

Request from Ecuador

A firm of representatives in Guayaquil, Ecuador, wishes to secure agencies for British manufacturers of insulated wires and cables, accessories and fittings for electrical installations. We will gladly give the firm's name to interested manufacturers, or pass on any communications.

Blue Book

The 1956 edition of the Electrical Trades Directory — the *Electrical Journal* Blue Book—is now available. Comprising some 65,000 references and occupying more than 1,600 pages, this 74th edition is classified under appropriate headings and conveniently arranged in sections, to which there is an index. Nearly 300 names of firms have been added to the list of manufacturing and other companies, bringing the total in that section to more than 6,760.

The number of headings in the products and materials section has also been increased. Included are the four major groups of manufacturers undertaking the production of nuclear power generating plant and equipment. The trade names section now contains more than 5,700 names of patented and branded articles.

The directory is published by Benn Brothers, Ltd., Bouverie House, Fleet Street, London, E.C.4, at £3 3s, post free.

Steel Production in America

Considerable expansion of the American steel industry is foreshadowed by the news that in recent weeks orders have been placed for over a dozen electric arc melting furnaces, each of more than a hundred short tons capacity. Of these, the majority are to be built by the Pittsburgh Lectromelt Furnace Corporation, whose licensees in this country are Birlec, Ltd., Birmingham.

New Head, Wrightson Subsidiary

In April last year Head, Wrightson & Co., Ltd., purchased Colliery Engineering, Ltd., of Sheffield. A new subsidiary company has now been formed, entitled Head, Wrightson Colliery Engineering, Ltd. The new company, with registered offices at Teesdale Iron Works, Thornaby-on-Tees, will have technical offices at Thornaby-on-Tees and Sheffield and will be able to handle complete surface reorganization or new projects. In particular, Thornaby will handle skip winding installations, towers and headframes, and all surface equipment including civil and electrical work, and Sheffield will deal with complete coal preparation plants.

Turbine Lubrication

After being out of print for about a year the Wakefield book "Turbine Lubrication" is again available in a revised form. The new edition embraces steam, water and gas turbine lubrication, a wider scope than that of the earlier book, and it has been entirely re-written. Copies are obtainable from the P. D. Department, Wakefield-Dick Industrial Oils, Ltd., Grosvenor Street, London, W.1.

Cookery for Demonstrators

Mrs. Marguerite Patten, the "television cook," gave a demonstration of pasta cookery before an audience of demonstrators from the London Electricity Board area at the Regent Street Service Centre of the Board on Wednesday last week. This demonstration was arranged in co-operation with the Macaroni Advisory Bureau as a prelude to the National Macaroni Week which commenced on Monday last.

Trade Announcement

The address of the **M.C.B. Co. (Manchester), Ltd.,** is now Lupus Works, Oxford Road, Altrincham, Cheshire (telephone: Altrincham 4041).

GENERATION AND DEVELOPMENT

720 MW Station for Northfleet

The Central Electricity Authority has received the consent of the Minister of Fuel and Power to the establishment of a new power station at Northfleet, Kent. It will have an installed capacity of 720 MW, consisting of six 120 MW turbo-generator sets each steamed by an 860,000 lb/hr boiler. This station is one of the new plants which will be designed to burn either oil or coal.

Boards' Capital Estimates Cut

After the Chancellor of the Exchequer's request last autumn for a reduction in expenditure, the Central Electricity Authority asked the Area Boards in England and Wales to revise their estimates, which aggregated some £70-80 million. It was announced last week that the Boards had made a 10 per cent cut in their estimated capital requirements for this year, amounting to approximately £10 million. Plans for new offices and showrooms will be mainly affected, but some rural development schemes may also be deferred.

Deferment of Rural Schemes

The Border (Cumberland) Rural District Council is to make representations to the Government, the Central Electricity Authority and the North Western Electricity Board against the slowing down of rural electrification. The Council has suggested that the amount spent by the Board on advertising should be reduced, saying that the annual expenditure is sufficient to supply electricity to about 500 farms.

The North Western Electricity Board has informed Alston (Cumberland) Rural District Council that it was intended to supply power to Nent Valley, but owing to present restrictions on expenditure it is not likely that the work will be carried out before 1960. The Council has asked the local branch of the National Farmers' Union to co-operate in securing an earlier starting date.

New Zealand Cable Link?

Following a tour of Europe and America to study trends and methods of power supply Mr. M. G. Latta, chief engineer of the New Zealand State Hydro-Electric Department, has suggested in a report that the laying of a submarine cable across the 20-mile Cook Strait dividing the North and South Islands should be investigated, saying that it is economically feasible and would allow the big potential resources of the South Island to be used to the advantage of the country as a whole. It would also mean that the need to build large and costly fuel or nuclear power stations would be avoided for many years to come.

Mr. S. Goosman, Minister in Charge of the Department, has agreed that the provision of a submarine cable link should be investigated but says that the proposal is "by no means an immediate possibility" and that probably no firm conclusion could be reached "within a couple of years."

Aswan High Dam

After a meeting with Mr. Eugene Black, president of the World Bank, the Egyptian Minister of Finance (Dr. Kaissouny) said last week that agreement had been reached on all points in the discussions on the financing of the Aswan High Dam project. The first five-year phase of building, which will begin in June, will require a dollar loan from the World Bank of £70 million, with further grants-in-aid by Britain and the United States.

New Londonderry Station

Londonderry Electricity Committee has recommended approval of the construction of a new generating station at St Columb's Park with an initial capacity of 60 MW but capable of extension up to 150 MW. The Committee also recommends that the station should be owned and operated by the Electricity Board for Northern Ireland, subject to rates on the full valuation of the new station being paid to the Corporation and to the existing station being designated in accordance with Section 17 of the Electricity Supply Act, 1948. Reporting to the Committee, Mr. S. A. Spence, the city electrical engineer, explained the advantage of having the present station designated so as to come within the co-ordinating powers and responsibilities of the Northern Ireland Joint Committee.

Mobile Service Centre

By the commissioning last week of a new mobile service centre, the Essex Sub-Area of the Eastern Electricity Board is now able to provide the rural districts of the county with the same showroom facilities which are enjoyed by the towns. Mounted on a Bedford omnibus chassis, this transportable "shop" provides showrooms and demonstration space, and electricity consumers in the most remote places will be able to pay their accounts, inspect many of the latest domestic appliances and watch them in operation, as well as receive advice on heating, lighting, cooking and washing problems. The service centre has been designed especially to the requirements of the Board. Power will be obtained from the nearest mains supply and wiring circuits are of sufficient size to provide electricity for a variety of domestic apparatus. Fluorescent lighting tubes are installed along the whole length of the body, an emergency lighting system being also provided from the battery of the vehicle. By means of a ring main, many power plugs are available and to these will be connected various appliances. Access to the service centre is by an aluminium stairway, which is carried within the body.

New mobile service centre of the Eastern Electricity Board

Nile Scheme Completed

The Kampala correspondent of *The Times* reports that the Uganda Electricity Board has completed the raising of the Nile above the Owen Falls to the same level as Lake Victoria. At the Owen Falls dam the river is now 18ft above its original level, and the Ripon Falls, marking the source of the Nile where it flows from Lake Victoria, are submerged. There was originally a 15ft drop at the Ripon Falls and the river fell a further 3ft in the two-mile stretch between the Ripon and the Owen Falls. The work would have been completed several months ago had not additional work been needed to protect the bridge carrying the main Kenya-Uganda railway, which crosses the Nile midway between the two sets of falls. With the disappearance of the Ripon Falls, a bronze plaque commemorating their discovery by Speke in 1862 is also submerged. A new memorial to Speke is planned to be erected on the river bank.

Expansion in Salisbury, Rhodesia

The need for making available adequate funds for distribution extensions is emphasized by Mr. J. C. Mitchell, B.Sc.Tech., M.I.E.E., M.I.Mech.E., city electrical engineer of Salisbury, Rhodesia, in his report for the year ended 30th June last. Mr. Mitchell says that at least £750,000 per annum is essential if the Depart-

ment is to provide the services laid down by statutory regulations. Should existing consumers press their claims for supply conditions as contracted for, the Department would have to cancel most of its development work and supplies to new consumers, with disastrous results to the economy of the undertaking and of the city. Capital work actually carried out by the distribution section last year amounted to £564,000.

The number of new consumers connected was a record at 1,769, making a total of 17,249. An indication of the extent of building development in Greater Salisbury is that the value of work for which plans were approved in the period July-November, 1955, was £4,550,000, an increase of more than 50 per cent on the corresponding period of the previous year. Electricity sales in the undertaking's area in 1954-54 amounted to 204 million kWh, an increase of 13 per cent. No changes have been made in tariffs since May, 1953, in spite of the continued rise in costs.

During the year No. 2 power station was brought up to its ultimate capacity with the commissioning of a second 20,000 kW set and two boilers, and work was started on the erection of the first two 210,000 lb/hr pulverized fuel boilers at the No. 3 station.

Ijora Power Station

Some particulars of the new Ijora "B" power station of the Electricity Corporation of Nigeria, which was formally inaugurated by the Queen on Friday last, were given in our issue of 3rd February. The Electricity Corporation has now issued, as a souvenir of the opening of the station, a well-produced brochure which, after outlining the history of the public electricity service in Lagos, describes and illustrates the new power station.

Underground Steam Power Station

The world's first large underground steam power plant is being built at Stenungsund, on the west coast of Sweden, and a contract for two boilers has been signed between the Swedish State Power Board and AB Svenska Maskinverken, who will be jointly responsible for the design of the plant.

The first boiler is to be delivered in 1959 and the second in 1960. Each will have an output corresponding to 465 tons of steam per hour, which is sufficient to operate a 150 MW turbo-generator. Two sets of this rating—the biggest so far to be built in Scandinavia—have been ordered from a Swedish firm. The station is designed for two more turbo-generators, with space also for a future atomic power plant.

The steam pressure of the boilers will be 1,920 lb/sq in and the temperature 1,000 deg F. They are to be of a special design particularly suitable for service underground. Each turbo-generator will be housed in a separate rock chamber measuring 330 by 80 by 100 ft. Oil firing will permit of large-scale automatization of operations.

The Stenungsund station is estimated to cost about £19,650,000, which is only about 10 per cent more than the cost of a conventional surface plant of the same size. Maintenance costs, on the other hand, will be considerably lower.

Colombo Tramway Abandonment

The Colombo Passenger Transport Committee has accepted a proposal to scrap its electric tramcars and replace them with diesel buses. The changeover is to begin in October this year. It is pointed out that the Municipal Council is losing Rs 800,000 a year on running the tramcars, which are nearly 40 years old.

The Municipal Council has adopted a motion calling upon the Government to allow the Council to extend the trolley-bus service in the city on seven additional routes. Meanwhile, the Municipality has contracted with an English firm for the erection of overhead lines and equipment so that the trolley-bus service can be extended by a further 2¼ miles.

Street Lighting Notes

Workmen have begun dismantling the gas lamps in the centre of BIRMINGHAM in preparation for a changeover to 1,000 W electric lamps, which will more than halve maintenance costs. Thoroughfares affected by the present conversion, which is expected to be completed by April, are Victoria Square and Corporation Street—the first stage of a plan to electrify all the city's street lighting. This will cost £1,300,000, spread over thirteen years. There are still 24,350 gas lamps in Birmingham streets. Including fuel, it is estimated that a gas street lamp in Birmingham costs £9 4s 9d a year to maintain, compared with £5 2s for its electrical counterpart. By changing over to electricity, the City Council hopes to save £65,000 a year.

ST. PANCRAS Highways Committee has accepted an offer by Thorn Electrical Industries, Ltd., to provide a trial installation of their "Alpha Two" 3-tube fluorescent lantern for Group "A" road lighting, subject to the company's replacing the existing installation as required. It is proposed that the trial installation shall be erected in Judd Street, from Euston Road to Tavistock Place.

BATTERSEA Borough Council has received sanction to a loan of £34,063 for the installation of new public lighting equipment.

HAMPSTEAD Works Committee has approved a joint scheme prepared by the Willesden Borough Council for relighting Kilburn High Road, using sodium discharge lanterns and 25ft concrete columns, at a total estimated cost of £16,130.

PADIHAM U.D.C. is applying for permission to borrow £6,700 for the conversion of 215 street lamps from gas to electricity.

REDCAR Corporation is seeking Ministry approval of a scheme, estimated to cost £16,000, for the carrying out of street lighting improvements.

BRADFORD City Council has approved a scheme submitted by the street lighting superintendent for street lighting on the Thorpe Edge housing estate (Section C, Part III) at an estimated cost of £1,035; and on the Tong estate (Section A) at a cost of £3,190.

BOLTON Lighting Committee is applying for sanction to borrow £4,534 for improving the lighting of main roads and bus routes in the borough during the financial year 1956-57.

STOCKPORT Corporation proposes to carry out the fourth stage of the scheme for the conversion of street lighting from gas to electricity at an estimated cost of £46,523, and also to convert street lighting at Underbank and Hillgate (£3,354).

ACCRINGTON Highways Committee has approved a scheme, estimated to cost £4,091, for the installation of sodium street lighting on the whole of the Laneside estate.

SWINDON Streets and Planning Committee has received the consent of the Minister of Housing and Local Government to borrow £5,038 for improved lighting in Shrivenham Road and Faringdon Road.

ST. HELENS Corporation has received Ministry approval of a lighting scheme for Marshalls Cross, estimated to cost £13,500.

SOUTHAMPTON Corporation is recommended to apply for sanction to borrow £2,226 for three street lighting schemes.

WALSALL Corporation is seeking sanction to borrow £4,734 for street lighting in Barton Dock Road.

During the coming financial year, the SCARBOROUGH Town Council is to spend £18,550 on the continuation of its scheme for converting street lighting from gas to electricity.

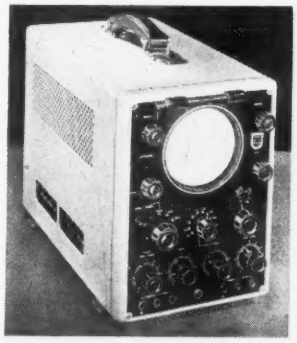
THORNABY-ON-TEES Corporation is seeking Ministry sanction to a street lighting scheme in Mandale Road, estimated to cost £2,839, and for similar work in Middlesbrough trunk road (£7,100).

The Ministry of Transport has sanctioned the borrowing of £3,501 by PENRITH U.D.C. for lighting the trunk road by electricity and work will begin shortly.

NEW ELECTRICAL EQUIPMENT

D.C. Coupled Oscilloscope

With a frequency range of 0-200 kc/s (−3dB) a new oscilloscope for investigating low frequency phenomena, such as occur in mechanical engineering when using strain gauges or vibration pickups, has been designed by PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2. Sensitivity is 180 mV (r.m.s.), but by means of the built-in r.c. coupled amplifier this can be increased to 500 mV (r.m.s.) for frequencies between 1 c/s and 100 kc/s. Despite an exceptionally good l.f. response, pulse voltages are reproduced with negligible distortion. Identical amplifiers with symmetrical coupling are used for both vertical and horizontal deflection. The time-base, either free-running or triggered, can be controlled continuously or in steps from 0·1 to 15,000 c/s. Three different cathode-ray tubes with varying persistence are available, each having a screen diameter of 10 cm.



Philips d.c. coupled oscilloscope (model GM5656)

Colour-Corrected 1kW Lamp

A new "Osram" colour-corrected mercury fluorescent lamp (class MBF/V) rated at 1kW has been introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. This has the same dimensions and electrical characteristics as the existing 1kW MB/V lamp and is intended for installations where good colour-rendering properties are important. Designed primarily for industrial lighting, specific applications of the lamp include the lighting of lofty buildings and area floodlighting. A particular advantage is its lower brightness, which gives reduced glare and permits lower mounting heights where necessary.

As in the case of the 1kW MB/V lamp, the colour-corrected type is designed for operation across two phases of a three-phase supply and is supplied in three distinct ratings, 350-370, 370-410 and 410-450V, a.c. It may be operated only in the cap up position. Initial light output is 52,000 lumens, and the average value throughout life is 45,000 lumens. The list price is £12.

Hand Lantern

An addition to the range of "Ray-O-Vac flashlights, available from ALPHA ACCESSORIES, LTD., Cae Mawr Factory, Treorchy, South Wales, is the 398 "Hunter" lantern which uses eight "Ray-O-Vac" 2LP leak-proof batteries.

Pre-focused for maximum brilliance, it has a 3in vacuum aluminized reflector. A switch, which incorporates a flasher-button, is conveniently placed at the top of the handle. The price, less batteries, is 16s 4d plus 3s 2d purchase tax in the United Kingdom.

"Ray-O-Vac" 398 "Hunter" lantern (Alpha Accessories)

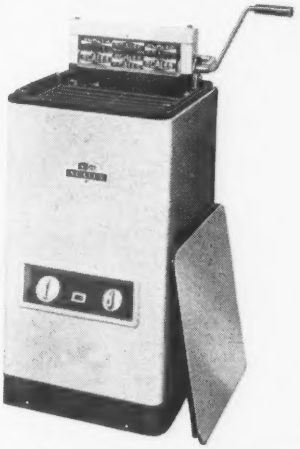
Washing Machines

It is announced by W. & S. SUMMERSCALES, LTD., Parkside Works, Keighley, Yorkshire, manufacturers of the "Scales" washing machine, that production has commenced on four new models, the S.1, S.2, SH.3 and SH.4. The last two are fitted with 3 kW heaters whereas the S.1 and S.2 are unheated. A time switch is incorporated in the S.2 and SH.2. Otherwise the machines are alike.

The black and white mottled vitreous enamel steel tub has a capacity of 6/8 lb of dry clothes and efficient agitation is created by a patented rotator at the bottom. A hand-operated 12in wringer, fitted with a detachable stainless steel handle, is mounted on pivots so that it may fold into the tub when not in use. A plasticated wire tray is also supplied to enable rinsed articles to be wrung through whilst washing continues.

A $\frac{1}{6}$ h.p. a.c. motor, powers the double reduction V-belt drive. Emptying is by means of a gravity drainage hose and fitted castors make it easy to move the washer. The finish is in white enamel with green plinth and red switch panel and external dimensions are 17½in square by 30¼in high. The height with wringer fitted is 36in. A white vitreous enamelled steel table top is also provided.

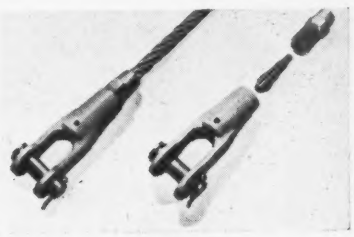
The prices are £35 4s (S.1), £39 8s (S.2), £40 9s (SH.3) and £42 11s (SH.4) plus £14 0s 7d, £15 17s 6d, £16 6s 8d and £17 5s 1d, respectively, for purchase tax in the United Kingdom.



"Scales" SH.4 washing machine (W. & S. Summerscales)

Wire Rope Terminal

A new type of wire rope terminal designed by the TULLOCH CONSTRUCTION CO., LTD., 70, Brighton Road, Sutton, Surrey, is considered an improvement on existing forms of attachment for wire ropes. The terminals consist of a compact assembly of three simple units: a sleeve to accommodate a given size and diameter of wire rope; a plug which is inserted to separate and hold the strands of the wire rope; and a terminal which can be made to suit the application. The sleeve and the terminal are made of forged alloy steel and the insert of shell cast gunmetal. Plug inserts are provided for different types of wire ropes and the lay of the wire is not affected or distorted by the use of these terminals.



Tulloch wire rope terminal

Multi-Purpose Lamp

In our issue of 20th January, page 123, the price of the "Drydex" multi-purpose hinged-head lamp (Chloride Batteries, Ltd.) was incorrectly printed as £10 10s. This should have been £1 10s, plus 5s 9d purchase tax.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 21st March from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

26390. Grosman, A.—Frequency changers. 30th October, 1950. (746,822.)

30278. National Research Development Corporation.—Electric pulse signalling systems. 13th December, 1950. (746,743.)

30279. Apparatus for synchronizing electric oscillations or trains of electric pulses. 13th December, 1950. (746,744.)

1951

25498. Siemens-Schuckertwerke Akt.-Ges. —Processes for the production of dry rectifiers. 31st October, 1951. (746,821.)

1952

13436. British Telecommunications Research, Ltd.—Telephone or like systems. 21st May, 1953. (746,942.)

20801. British Thomson-Houston Co., Ltd.—Electric flash-discharge lamps. 24th June, 1953. (746,752.)

21461. Siemens-Reiniger-Werke Akt.-Ges.—Electro-medical apparatus for stimulating current therapy. 26th August, 1952. (746,665.)

23535. Standard Telephones & Cables, Ltd.—Storage of intelligence. 11th September, 1953. (746,666.)

23607. Sangamo Weston, Ltd.—Electrical integrating apparatus. 19th September, 1952. (746,947.)

24410. Telefunken Ges.—Valves of the travelling-wave type. 30th September, 1952. (746,753.)

30359. English Electric Co., Ltd.—Liquid-filled electrical apparatus. 26th February, 1954. (746,829.)

1953

4981. General Motors Corporation.—Control systems for power plants. 23rd February, 1953. (746,903.)

6824. British Thomson-Houston Co., Ltd. —Bulb-washing and reflector-coating apparatus. 12th March, 1953. (746,668.)

7019. General Electric Co., Ltd., Bate, H. C., and Bowtell, J. N.—Electro-luminescent devices. 12th March, 1954. (746,669.)

8462. Electric & Musical Industries, Ltd. —Thermostatic electric hand irons. 29th March, 1954. (746,836.)

10499. Ferranti, Ltd.—Electro-photographic systems. 15th April, 1954. (746,905.)

11326.—Steatit-Magnesia Akt.-Ges.—Dielectrics. 24th April, 1953. (746,839.)

14160. Babcock & Wilcox, Ltd.—Tubulous vapour generating and vapour heating units and the heating of vapour therein. 20th May, 1954. (746,844.)

14451. Baxendale, R., Baxendale, J., Baxendale, P. S., and Baxendale, M. J.—Domestic hot-water systems. 7th May, 1954. (746,845.)

17038. Standard Telephones & Cables, Ltd.—Electrical contact springs for contact operating devices. 19th June, 1953. (746,849.)

17319. Electric & Musical Industries, Ltd. —Thermoplastic electric hand irons. 14th June, 1954. (746,851.)

18547. American Danish Oticon Corporation.—Electro-acoustic devices. 3rd July, 1953. (746,773.)

22026. Philips Electrical Industries, Ltd. —Apparatus embodying cathode-ray tubes. 10th August, 1953. (746,777.)

22653. Standard Telephones & Cables, Ltd.—Timing equipment. 17th August, 1953. (746,672.)

22886. General Electric Co., Ltd., and Rose, W. R.—Contact wiper assemblies for electromagnetic step-by-step switches. 19th August, 1954. (746,960.)

25370. Welwyn Electrical Laboratories, Ltd., and Whitfield, E. H.—Electrical resistors. 14th September, 1953. (746,781.)

28166. Philips Electrical Industries, Ltd. —Devices for coupling two coaxial shafts. 13th October, 1953. (746,871.)

32006. Hunt (Capacitors), Ltd., A. H.—Sealed electrical units. 18th November, 1954. (746,969.)

34175. Marconi's Wireless Telegraph Co., Ltd.—Method of adjusting the frequency of piezo-electric crystals. 10th August, 1954. (746,971.)

1954

358. Compagnie Générale d'Eléctricité. —Amplifier of which the gain characteristics as a function of the frequency are variable as a function of time. 6th January, 1954. (746,886.)

968. Westinghouse Electric International Co.—Electric heating apparatus. 13th January, 1954. (746,796.) 2892. Electric surface-heating units adapted to support cooking vessels or the like. 1st February, 1954. (746,911.)

1985. General Electric Co., Ltd., and Biggs, A. J.—Colour television receivers. 20th January, 1955. (746,797.)

3160. Porter Electrical Products, Ltd.—Electrical conductors. 26th January, 1955. (746,979.)

3564. Telefunken Ges.—Wave attenuating arrangements. 8th February, 1954. (746,798.)

4716. Radio Corporation of America. —Magnetic switching device. 17th February, 1954. (746,983.)

4868. Telefonaktiebolaget L. M. Ericsson.—Signal receivers for carrier telecommunication systems. 18th February, 1954. (746,698.)

4964. Standard Telephones & Cables, Ltd.—Ring filter circuit. 19th February, 1954. (746,890.)

6089. Philips Electrical Industries, Ltd. —Low-pressure arc-discharge tube circuit arrangements. 2nd March, 1954. (746,916.)

6137. Vereinigte Aluminium-Werke Akt.-Ges.—Continuously formed electrodes for electric furnaces. 2nd March, 1954. (746,917.)

6509. English Electric Co., Ltd.—Pressure charged internal-combustion engines. 18th June, 1954. (746,800.)

7516. Napier & Son, Ltd., D.—Electrical generating units. 4th March, 1955. (746,894.)

7980. Blaupunkt-Werke Ges.—Antenna circuit arrangements for radio receivers. 18th March, 1954. (746,985.)

10192. Olin Mathieson Chemical Corporation. — Electrically-insulated conduit couplings. 7th April, 1954. (746,989.)

10680. Rava, E.—Frequency convertor. 12th April, 1954. (746,920.)

11504. Lumalampan Aktiebolag.—Electrode for electric-discharge tubes. 21st April, 1954. (746,990.)

12486. General Electric Co.—Electric cookers. 29th April, 1954. (746,713.)

12583. Babcock & Wilcox, Ltd.—Cyclone furnaces. 30th April, 1954. (746,714.)

13618. Brodie Co., R. N.—Variable ratio transmission. 10th May, 1954. (746,717.)

15735. Philips Electrical Industries, Ltd. —Carrier-wave telegraphy. 27th May, 1954. (746,726.)

17598. Hoover, Ltd.—Armatures for dynamo-electric machines. 15th June, 1954. (746,897.)

18485. Hutchins Electric Co., Inc.—Electric motors. 23rd June, 1954. (746,930.)

18568. Brush Group, Ltd.—Alternator exciters. 23rd December, 1954. (746,929.)

20051. General Electric Co.—Tapped electric coils. 8th July, 1954. (746,932.)

20355. General Electric Co.—Fluid compressors. 12th July, 1954. (746,811.)

21789. Curtiss-Wright Corporation.—Radio navigation simulation apparatus. 26th July, 1954. (746,732.)

25114. Fernseh Ges.—Television camera apparatus. 30th August, 1954. (746,899.)

25291. General Electric Co.—Thermo-electric elements. 31st August, 1954. (747,009.)

26164. Akt.-Ges. für Unternehmungen der Eisen-und-Stahlindustrie.—Method of producing a favoured direction of magnetization in permanent magnets made from oxides of metals. 9th September, 1954. (746,935.)

27218. Sulzer Frères Soc. Anon.—Forced flow, once through steam generators. 20th September, 1954. (746,733.)

28376. General Railway Signal Co.—Automatic control of railway car retarders. 1st October, 1954. (746,735.)

31378. Technograph Printed Circuits, Ltd.—Electric circuit components. 2nd October, 1952. (746,936.)

32022. Bosch Ges., R.—Switch arrangement for reversing electric starting motors of two-stroke internal-combustion engines. 5th November, 1954. (746,816.) 32343. Starting motor arrangements for internal-combustion engines. 9th November, 1954. (746,817.)

35820. Bendix Aviation Corporation.—Method of making electrical coils for high temperature use. 10th December, 1954. (746,739.)

1955

19451. British Telecommunications Research, Ltd.—Telephone or like systems. 21st May, 1953. (747,010.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 25th February:—

BEREC BATRYMAX (design). No. 738,010. Class 9. Electric batteries, electric cells and accumulators; and radio apparatus operated by electric batteries, electric cells and accumulators. BEREC BATRYMAX (design). No. B738,011. Class 11. Torches, electric lamps and electric lamp bulbs.—Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7.

CHEVRON. No. 744,784. Class 9. Electric vacuum cleaning apparatus.—A. Nehorai, 64a, Kensington Church Street, London, W.8.

ADSUM. No. 747,621. Class 9. Radio navigation apparatus, direction finding apparatus and radar apparatus. — International Marine Radio Co., Ltd., Intelco House, 21, Progress Way, Croydon, Surrey.

BRAYHEAD. No. B747,729. Class 9. Parts and fittings included in Class 9 for radio, radio-gramophone, cinematographic and television apparatus and for electric and electronic instruments.—Brayhead Springs, Ltd., Full View Works, Kennel Ride, Ascot, Berks.

ASHAPRENE. No. 747,851. Class 9. Cables. —Shardlow Electric Wires, Ltd., Corn Exchange Buildings, Hanging Ditch, Manchester, 4.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—20th March. Posts and Telegraphs, Melbourne. 2,000 switch maintenance parts. (E.S.B. 2291/55. Ten/17743.)*

Belfast.—20th February. Northern Ireland Housing Trust. Electrical installations in 87 dwellings at Grove site and 12 at Hilden, Lisburn. Offices of the Trust, 12, Hope Street, Belfast.

Blackpool.—3rd March. Borough Council. Electric lamps for the year ending 31st March, 1957. (See this issue.)

Burma.—22nd February. Burma Purchase Board. Lighting equipment including hand lamps, weatherproof and street lighting fittings, switches and fuses. (E.S.B. 3338/56. Ten/17869.)* 24th February. T.r.s. twin core cable. (E.S.B. 3340/56. Ten/17870.)*

Canada.—28th February. Manitoba Hydro-Electric Board. Instruments and control equipment for four 30,000 kW turbo-generators together with boilers and auxiliary equipment. (E.S.B. 2836/56. Ten/17856.)*

Dumfries.—Burgh Council. Switchgear for two pumping stations and sewage purification works. (See this issue.)

Formosa.—28th March. Central Trust of China, Purchasing Dept., Taipei. 54,000 kVA generator for a hydro-electric power station. (E.S.B. 2425/56(ICA). Ten/17789.)*

French Equatorial Africa.—5th March. Postal and Telegraph Dept. of the Cameroons, Douala. Generating sets ranging from 10-60 kVA. (E.S.B. 3047/56. Ten/17821.)*

Friern Barnet.—27th February. U.D.C. Supply of metal filament lamps and sodium vapour lamps and jackets for the year commencing 1st April, 1956. (See this issue.)

Gateshead.—14th March. Borough Council. Street lighting equipment. (See this issue.)

Great Yarmouth.—3rd March. Electric cables for one year commencing 1st April, 1956. (See this issue.)

India.—22nd February. Director General of Supplies and Disposals, New Delhi. Multicore cable. (E.S.B. 2989/56. Ten/17823.)* 28th February. Electric motor testing equipment. (E.S.B. 2533/56. Ten/17699.)* 30th April. Damodar Valley Corporation, Electricity Dept. 50 MW or 75 MW turbo-generator for Bokaro thermal power station. (E.S.B. 2788/56. Ten/17780.)*

Irlam.—25th February. U.D.C. Electric lamps for the year ending 31st March, 1957. U.D.C. surveyor, Council Offices, Irlam, near Manchester.

Llandudno.—20th March. U.D.C. Street lighting conversion. (See this issue.)

Manchester.—South Manchester Hospital Management Committee. Applications are invited from firms wishing to be placed on the approved list for carrying out maintenance and decorative works at hospitals and clinics. (See this issue.) 29th February. Education Committee. Removal of existing lift at the College of Technology and the supply and installation of a new electrically operated lift. Chief engineer and works superintendent.

Siam.—24th February. Royal Irrigation Dept. 37 items of electrical distribution equipment and cable including lightning arresters, switches, insulators and insulated and bare cable, for Yanhee Tunnel Works. (E.S.B. 2454/56. Ten/17794.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Sodbury.—9th March. R.D.C. Two vertical spindle non-chokeable type centrifugal pumps, with electric motors, starters, switchgear, etc., for sewage pumping station at Yate Aerodrome Housing Site. J. B. Bennett, city engineer, 470, Bath Road, Brislington, Bristol, 4.

South Africa.—22nd February. Stores Dept., South African Railways. Insulated cable. (E.S.B. 2501/56. Ten/17733.)* 29th February. 400 kVA transformer, switchboard and oil circuit breaker. (E.S.B. 2504/56. Ten/17765.)* 2nd March. Oil circuit breakers and switchboards. (E.S.B. 2698/56. Ten/17737.)* Transformers. (E.S.B. 2699/56. Ten/17761.)* Fifteen generating sets. (E.S.B. 3127/56. Ten/17797.)*

Syria.—10th March. Director General of Post, Telegraphs and Telephones, Damascus. 1,000 telephones and 101 transformers. (E.S.B. 2619/56. Ten/17801.)*

Tangier.—11th April. Electricity and Water Board. Electrical equipment for a 5,500 V disconnecting station. (E.S.B. 2348/56. Ten/17769.)*

Uruguay.—20th March. Ministerio de Salud Publica. X-ray equipment. (E.S.B. 2645/56. Ten/17719.)*

Walthamstow.—22nd February. Borough Council. Supply of electrical conduit tube (form No. 17); electrical cords and cables (18); and electric lamps—tungsten, street lighting, etc. (19), for the year ending 31st March, 1957. Borough architect, Town Hall, E.17.

Wiltshire.—20th March. County Council. Electrical installation at Upavon New Primary School. (See this issue.)

ORDERS PLACED

Bromsgrove.—Birmingham Regional Hospital Board. Electrical installation work at Barnsley Hall Hospital (£5,886).—B. French.

Chislehurst and Sidcup.—U.D.C. Sodium lighting, Sidcup Road and along the by-pass (£6,200).—B.T.H. Co.

Cirencester.—U.D.C. Mercury discharge lighting installation along about 2 miles of trunk road (£8,136).—Metropolitan-Vickers.

Edmonton.—Housing and Building Committee. Electrical installation work at Potters Bar housing scheme No 44 (£10,545).—Holliday, Hall & Stinson.

Glasgow.—Education Committee. Electrical work at Ruchazie Primary School (£2,595).—Claud Hamilton.

Ipswich.—Paving and Lighting Committee. Recommended. Sodium lighting in Woodbridge Road East and Colchester Road (£1,977).—Revo Electric Co.

London.—Poplar Contracts and Purchasing Committee. Electrical installations in Blocks 24a and 24b of flats in the Abbott Street area (£2,400).—London Electricity Board.

Montrose.—British Railways (Scottish Region). Electric lighting installation at Montrose passenger and goods stations, motive power depot and signal cabins.—J. Scott & Co.

Redcar.—Corporation. Installation of street lighting from Broadway to the Coast Road (£16,248).—North Midland Engineering Co.

Richmond (Yorks).—Corporation. Recommended. Street lighting, Cutpurse Lane housing estate, Gallowgate, King Street, and road A.6108 (£5,360).—Metropolitan-Vickers.

Salford.—Watch Committee. Recommended. Electrical installation works at new police headquarters (£13,900).—Bonney & Co. (Bolton).

Walthamstow. — Corporation. Electrical installation work at the fourth area of The Drive (£2,080).—Woodford Electrical Co.

Walton and Weybridge.—U.D.C. Lighting in various streets (£20,380).—Metropolitan-Vickers.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alvechurch.—Research block (£50,000); British Cast Iron Research Association, Bordesley Hall, Alvechurch, near Birmingham.

Aylesbury.—Factory and offices in the Bicester Road area, for Fixol and Stickphast, Ltd.; Ian H. McLaren, architect, 6, Broadway, Wimbledon, S.W.19.

Barnsley.—Branch library at Kendray estate; E. Cutts, Ltd., Barnsley.

Barrow-in-Furness.—Conversion of Farm Street Hostel into factory; Zenith Carburettor Co., Ltd., Honeypot Lane, Stanmore.

Basingstoke.—Factory, Winchester Road; Hubbard Bros., Ltd., auto engineers, Reading Road.

Beckenham.—Block of shops and flats; Compton Bros., Ltd., builders, 185/9, Beaconsfield Road, Enfield.

Bedford.—Flats (36), Monkshill (£60,861); Lindum (Lincoln), Ltd., builders, Cauldwell Walk, Kempston Road.

Birmingham.—Seven-storey flatted factory, with lifts, Blucher Street/Holloway Head corner site, in connection with Bath Row Redevelopment, and old people's home in Sutton Road, Erdington (£65,000); A. G. Sheppard Fidler, city architect, Civic Centre, 1.

Camborne.—Shops and offices, Trelowarren Street and Commercial Square; J. Garrett & Son, Ltd., builders, Embankment Lane, Prince Rock, Plymouth.

Durham.—Houses (48), Newton Hall estate; J. W. Green, city engineer.

Eckington.—Fire station for Derbyshire C.C. (£28,000); county architect, Derby.

Enfield.—Factory, warehouse and canteen, Mollison Avenue, for Le Bas Tube Co., Ltd., 129, Finsbury Pavement, E.C.2; Percy Bilton, Ltd., 113, Park Street, Mayfair, W.1.

Gateshead.—Junior school, Bensham Road; borough surveyor.

Factory additions, South Shore Road for Northumberland Press, Ltd.; Arthur and Kirkup, architects, 13, Swinburne Street.

Houghton-le-Spring.—Factory for N. Hyer, Ltd.; Mauchlen, Weightman and Elphick, architects, 12, Saville Row, Newcastle-on-Tyne.

Ilford.—Chemical research laboratory; Thorium, Ltd., Uphall Road.

Ipswich.—Houses (118), Chantry estate; Macro, Ltd., builders, 6, Pine Avenue.

Thurleston Secondary School; Johns & Slater, architects, 32, Foundation Street.

London.—Out-patients' department, London Chest Hospital, Bethnal Green; Saxon, Snell and Phillips, architects, 9, Bentinck Street, W.1.

Offices, Fetter Lane; Harry Neal, Ltd., builders, 117, Baker Street, W.1.

Block of flats, Sussex Gardens, Paddington; Parway Estates, Ltd., 194, Finchley Road, N.W.3.

Works, Brunswick Square, Tottenham; P. Hartstein, Ltd., 64, Commercial Street, E.1.

Administrative centre, Great Portland Street, W.1 (£100,000) for Timber Development Association, Ltd., 21, College Hill, E.C.4.; John Leaning & Sons, quantity surveyors, 28, John Street, Holborn, W.C.1.

Lyme Regis.—Workshops and offices, Millgreen; Jenkins & Lancefield, Bramhill, Calne.

Manchester.—North Manchester High School for Girls, Moston, and extensions and alterations to Brownley Green Secondary School, Wythenshawe; city architect, P.O. Box No. 488, Town Hall.

R.C. school of St. Clare, Blackley; W. J. Simms, Sons & Cooke, Ltd, Nottingham.

Seven-storey office block at Queen Street for Rose Diamond Estate, Ltd.; Cruikshank & Seward, architects, 196, Deansgate.

Matlock.—Houses (50), Woulds; Butterley Co., Ltd., Ripley.

Middlesbrough.—Large additions to stores for Marks and Spencer, Ltd.; Norman Jones and Rigby, architects, Lord Street, Southport.

Oxygen producing plant at Lackenby for the British Oxygen Co., Ltd., Bridgewater House, Cleveland Row, London, S.W.1 (£500,000).

Newark.—Houses (227), Hawtonville; borough surveyor, 20, Baldertongate.

Newcastle-on-Tyne.—Primary school at Kenton; Fielden and Wharfe, architects, 27, Ridley Place, Newcastle.

Factory at Fawdon for Rowntree and Co., York (£1,000,000); John Laing & Sons, builders, Dalston Road, Carlisle.

Newton Aycliffe.—Houses (121) for Development Corporation; A. V. Williams, general manager, Newton Aycliffe, Co. Durham.

Northallerton.—Houses (100); U.D.C. surveyor.

Northenden (Manchester).—Factory and offices, Carrsfield and Shentonfield Roads; Hilson Wire Products, wire workers, Shepley Works, Audenshaw, Denton.

Nottingham.—Laboratories and offices, Stoke Bardolph Sewage Works; city engineer.

Oxford.—Office building, London Road; A. C. Nielsen & Co., Ltd., 109, St. Aldates.

Penrith.—Dance and concert hall, Princes Street (£25,000); R. E. Reay & Son, builders.

Perth.—Three-storey flats (100), Leetham site; Scottish Special Housing Association, Ltd., 15, Palmerston Place, Edinburgh.

Portsmouth.—Administration block, workshops and offices; Fraser & White, Ltd., Quay House, Broad Street.

Redditch.—Foundry and offices, Studley Road; Reynolds Light Alloys, Ltd., Hay Hall Works, Acocks Green, Birmingham, 11.

Romford.—Area offices and stores, Crow Lane; Essex Rivers Board, Springfield Road, Chelmsford.

Ross-on-Wye.—Divisional police headquarters for Herefordshire Standing Joint Committee; William Bowers & Co. (Hereford), Ltd., builders, Bath Street, Hereford.

Rotherham. — Congregational church, Wickersley Road; J. Mansell Jenkinson & Son, architects, 18, Norfolk Row, Sheffield, 1.

Houses (100), Kimberworth Park; Beeden, Ltd., builders, Thrybergh, Rotherham.

South Shields.—Block of offices, extensions at Town Hall (£80,000); J. Reid, borough surveyor.

Cleadon Park Open-Air School (£55,000); D. Glen, Ltd., builders, Albert Road, Jarrow-on-Tyne.

Standish-with-Langtree. — Houses (70); U.D.C. Surveyor's Department, Ashfield House, Standish, near Wigan.

Stockton-on-Tees.—Office block, Grangefield Road, for A. E. Gray and Son; G. P. Stainsby, architect, 57, High Street.

Swansea.—Showrooms and offices, High Street; Lennards, Ltd., Soundwell, Bristol.

Teddington.—Flats (65), Little Queen's Road, for Twickenham T.C.; A. S. Knolles, borough surveyor, Municipal Offices.

Tiptree.—County secondary school; H. & H. M. Lidbetter, architects, 2, Verulam Buildings, Gray's Inn, London, W.C.1.

Tunbridge Wells.—Dwellings (50), Tonbridge Road Estate; borough surveyor.

Wolverhampton.—Blocks of shops and offices (£285,000), in connection with market hall scheme at Brick Kiln Court; J. Brock Allon, town clerk, Town Hall.

Offices, stores and canteen; British Oxygen Engineering, Ltd., Wood Street.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates do not clash with others already arranged

Monday, 20th February

BIRMINGHAM.—Grand Hotel, 6.15 p.m. Birmingham Electric Club. "Modern Developments in Electric Furnaces," by R. A. Smith.

BRISTOL. — S.W.E.B. Demonstration Theatre, Colston Avenue, 6 p.m. I.E.E. Western Supply Group. "Electrical Energy from the Wind," by E. W. Golding.

IPSWICH. — Electric House, 7.15 p.m. Ipswich & District Electrical Association. Discussion evening.

LIVERPOOL.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey & North Wales Centre. "A Transatlantic Telephone Cable," by Dr. M. J. Kelly, Sir Gordon Radley, G. W. Gilman and R. J. Halsey.

LONDON.—Savoy Place, W.C.2., 5.30 p.m. I.E.E. Radio & Telecommunication Section. Informal evening, "Ultrasonics in Industry," by C. F. Brocklesby.

NEWCASTLE-UPON-TYNE. — King's College, 6.15 p.m. I.E.E. North-Eastern Radio & Measurement Group. "High Speed Photography," by W. D. Chesterman.

Neville Hall, 7 p.m. Institution of Production Engineers, North Eastern Region. "Remote Positional Control and its Possible Application to Automation," by J. D. Oates and A. T. Granger.

WORCESTER.—Hilton Road M.E.B. Social & Sports Club, 6 p.m. I.E.E. South Worcestershire Group. Informal lecture on "The Recent Search for and Salvage of the Comet Aircraft near Elba," by Cdr. C. G. Forsberg, R.N., and G. C. MacNeice.

Tuesday, 21st February

CHELMSFORD. — Public Library Lecture Room, Duke Street, 7.30 p.m. Institute of Industrial Supervisors, Mid-Essex Section. "Automation," by S. Waugh.

CHELTENHAM.—47, Promenade, 6.30 p.m. I.E.S. Gloucester & Cheltenham Centre. "Lighting for Decoration," by A. E. Hurst.

COVENTRY.—Coventry Electric Club. "The Story of Copper."

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "The Supply of Electricity in the London Area," by D. B. Irving.

LEEDS. — 1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Utilization Group. "Age and the Incidence of Fires in Electrical Installations," by L. Gosland.

LIVERPOOL.—9, The Temple, Dale Street, 6 p.m. I.E.S. Liverpool Centre. "The Effect of the Lighting Load," by W. B. Parkinson.

LONDON.—2, Savoy Hill, W.C.2., 6.30 p.m. Association of Supervising Electrical Engineers. National lecture, "Power from the Sun," by Miss M. V. Griffith.

MANCHESTER. — Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Measurement & Control Group. Discussion on "Fault Recording Instrumentation on a Power Supply System," opened by W. Casson and L. Csuros.

NEWCASTLE-UPON-TYNE. — Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North Eastern Graduates' & Students' Section. "Local Government Engineering," by R. Green. (Joint meeting with the Students' Sections of the Institutions of Civil and Mechanical Engineers and the North East Coast Institution of Engineers & Shipbuilders).

NOTTINGHAM.—College of Arts & Crafts, 6.30 p.m. I.E.E. East Midland Centre. "The Electrical Measurement of Steam-Turbine Rotor Movements, with special reference to the Operation and Design of Modern Power Plant," by J. L. Ashworth, J. S. Hall and A. H. Gray. (Joint meeting with the East Midlands Branch of the Institution of Mechanical Engineers).

PORTSMOUTH.—"Air Balloon," 598, Commercial Road, Mile End, 7.30 p.m. A.S.E.E. Portsmouth Branch. "Cinema Installations," by W. B. Butler.

RUGBY.—College of Technology & Arts. 6.30 p.m. I.E.E. Rugby Graduates' & Students' Section. "Air Blast Circuit Breakers," by G. A. Jack.

Wednesday, 22nd February

CHESTER.—5, King's Buildings, King Street, 7 p.m. Society of Instrument Technology, Chester Section. "Mass Spectrometers."

GLASGOW.—39, Elmbank Crescent, 7 p.m. British Institution of Radio Engineers, Scottish Section. "Colour Television," by B. V. Somes-Charlton.

LEICESTER.—Hotel Victory. Incorporated Plant Engineers, Leicester Branch. Ladies' Night and Dinner.

LONDON.—Savoy Place, W.C.2., 5.30 p.m. I.E.E. Supply Section. "The Penetration of Surge Voltages through a Transformer Coupled to an Alternator" and "The Propagation of Surge Voltages through Turbo-Alternators with Concentric Conductor Type Windings," by Dr. B. C. Robinson.

MIDDLESBROUGH.—Cleveland Scientific & Technical Institution, Corporation Road, 6 p.m. North East Coast Institution of Engineers & Shipbuilders, Tees-Side Branch. "Nuclear Reactors for the Generation of Power," by C. E. Iliffe.

NOTTINGHAM. — E.M.E.B. Showroom Theatre, Smithy Row, 7.30 p.m. A.S.E.E. Nottingham Branch. Ten-minute papers.

PORTSMOUTH.—College of Technology Extension, Anglesea Road, 6.30 p.m. I.E.E. Southern Centre. "Applications of Protective Gear," by S. A. Wheeler. (Joint meeting with the Graduates' & Students' Section).

TREFOREST.—Glamorgan Technical College, 6.30 p.m. British Institution of Radio Engineers, South Wales Section. "Colour Television," by Dr. G. N. Patchett.

Thursday, 23rd February

GLASGOW.—I.E.S. Glasgow Centre. Informal dinner-dance.

LONDON.—Grosvenor House, Park Lane, W.1., 7 for 7.30 p.m. Institution of Electrical Engineers. Annual dinner.

Connaught Rooms, W.C.2, 12.30 for 12.55 p.m. Batti-Wallahs' Society. Luncheon.

PORTSMOUTH.—Central Electricity House, 7 p.m. Institute of Industrial Supervisors, Southern Section. "The Theory and Practice of Plant Maintenance," by C. Ungoed and D. H. Mustoe. (Joint meeting with the Institution of Production Engineers, the Institute of Industrial Administration and the Electrical Power Engineers' Association).

Friday, 24th February

BIRMINGHAM.—Regent House, St. Philip's Place, Colmore Row, 6 p.m. I.E.S. Birmingham Centre. Annual general meeting, followed by address by the vice-president, A. G. Penny.

BRISTOL.—Royal Hotel, 7 p.m. I.E.S. Bath & Bristol Centre. "Black Light," by R. V. Mills.

COLCHESTER.—Red Lion Hotel. Ipswich & District Electrical Association. Ladies' Night.

LONDON.—Savoy Place, W.C.2., 5.30 p.m. I.E.E. Supply Section "The Crossing of the Messina Straits with 230 kV Double-Circuit Overhead Transmission Line," by F. Bianchi.

A.S.E.E. South-West London Branch. Annual dinner.

PETERBOROUGH. — Grand Hotel. Incorporated Plant Engineers, Peterborough Branch. Ladies' Night.

Saturday, 25th February

LONDON.—I.E.E. London Graduates' & Students' Section. Visit to Central Electricity Authority, Bankside House (Progress Room), at 11 a.m.